CMER WORK PLAN
2004

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COOPERATIVE MONITORING, EVALUATION AND RESEARCH COMMITTEE

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1.0 INTRODUCTION

1.1 BACKGROUND ON ADAPTIVE MANAGEMENT

The State Forest Practices Board (FPB) has adopted an adaptive management program in concurrence with the Forest and Fish Report legislation (State Forest Practices Rules WAC *222-12-045). The purpose of this program is to:

> "…provide science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives."

To provide the science needed to support adaptive management, the FPB established the Cooperative Monitoring, Evaluation and Research Committee (CMER). The FPB empowered CMER to implement, research, effectiveness, and validation monitoring per guidelines set by the Forest and Fish Report (FFR). CMER is organized into a series of Scientific Advisory Groups (SAGs) that are responsible for designing and implementing the research and monitoring program.

1.2 PURPOSE AND OBJECTIVES OF THE CMER WORK PLAN

The goal of this work plan is to provide an integrated strategy for how CMER will monitor the effectiveness of the Forest and Fish rules to protect and maintain aquatic resources. The work plan is intended to inform CMER participants, policy constituents, and the interested public in CMER's activities. The plan is a living document that will be revised in response to research findings, changes in policy objectives, and funding. Currently, the work plan is updated on an annual basis.

The work plan goal will be met by achieving six objectives:

1. Identifying critical research and monitoring questions (a process started in appendix LI and L2, FFR Report) that are pertinent to evaluating rule effectiveness
2. Organizing these questions into coherent program groupings
3. Assessing the risk and scientific uncertainty for each program
4. Developing an integrated strategy for accomplishing the work
5. Prioritizing programs/projects for implementation
6. Developing budget estimates and timelines for implementation.

1.3 ORGANIZATION OF THE WORK PLAN DOCUMENT

The work plan is organized in a hierarchical format. FFR "rule" groups form the highest level, programs occur within rule groups, and projects are defined within programs (e.g., Table 2). Functionally, research and monitoring questions are identified at the rule group level and are assigned to programs (topic groups). Then projects are developed with the programs for implementation of monitoring. In the remainder of this section we further define the rule groups and programs, and introduce the monitoring task framework that is being used by CMER. Sections 2 and 3 provide detailed descriptions of the Rule Groups and Programs, respectively.

Section 4 describes how CMER used an assessment of risk and scientific uncertainty to prioritize and rank the monitoring programs.

1.3.1 Rule Group Structure and Definition

A rule group is a set of forest practices rules relating either to a particular resource, such as wetlands, or fish-bearing streams, or to a particular type of forest practice, such as roads construction and maintenance.

The rule groups are mostly organized along the lines of the appendices in the FFR, including:

1. Riparian Strategy (FFR, Appendix B) which includes five sub-groups:
   a. Stream Typing
   b. Type N Streams
   c. Type F streams
   d. Bull trout
   e. Channel Migration Zones (CMZ)
2. Unstable Slopes (FFR, Appendix C)
3. Roads (FFR, Appendix D)
4. Fish Passage (included in FFR, Appendix D, Roads)
5. Pesticides (FFR, Appendix E)
6. Wetland Protection (FFR, Appendix F)
7. Wildlife

1.3.2 Program Structure and Definition

A program is a combination of one or more projects that is designed to address a series of related scientific questions for a specific rule group. CMER organized all critical questions and issues into one or more research/monitoring programs. A description of each program including the purpose and objectives of the program and the strategy for accomplishing the work is presented in Section 2.

1.3.3 Task Descriptions

CMER defined several task categories to facilitate effectiveness monitoring over different spatial and temporal scales. This integrated approach includes an effectiveness monitoring task to evaluate prescription effectiveness at the site scale; an extensive monitoring task to evaluate status and trends in resource condition indicators across FFR lands; and, the intensive monitoring task to measure watershed-scale monitoring of causal relationships and cumulative effects. CMER also defined a rule implementation tool task to coordinate the development of scientific tools necessary for implementing the rule(s). CMER collaborates with the DNR on designing programs for rule implementation tools.

A more detailed description of these tasks follows. The rationale for this integrated monitoring approach is described in the Monitoring Design Team (MDT) Report.

1.3.4 Effectiveness/Validation Monitoring

Effectiveness monitoring/validation projects are designed to evaluate the performance of the prescriptions in achieving resource goals and objectives. Effectiveness monitoring may include several related projects such as research tool development and validation, pilot study, target identification, and effectiveness monitoring projects. Effectiveness monitoring differs from the other approaches in that it is directed at prescription effectiveness at the site-scale.

1.3.5 Extensive Monitoring

Extensive monitoring evaluates the current status and future trends of key watershed input processes and habitat conditions across FFR lands statewide. Extensive monitoring is a statewide assessment of the effectiveness of FFR rules to attain specific performance targets across FFR lands. This is different from prescription effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide annual report-card-type measures of rule effectiveness (i.e., do we meet the performance targets or how much have we improved over time) that can be used to determine if progress is consistent with expectations.

1.3.6 Intensive Monitoring

Intensive monitoring is watershed-scale monitoring that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR rules on aquatic resources. The evaluation of cumulative effects from multiple management actions on a system requires an understanding of how individual actions influence a site and how those responses propagate through the system. This understanding will enable the effectiveness-evaluation of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. Several potential intensive monitoring topics have been identified, and CMER is currently scoping critical questions that need to be addressed by an integrated intensive monitoring program

1.3.7 Rule Implementation Tool Development in cooperation with DNR

Rule implementation tool development includes efforts to develop, refine or validate tools used to implement the rules. Typical projects include the development, testing, and refinement of field protocols or models that would be used to identify or delineate landscape features that require FFR prescriptions. For example, the Last Fish Model will be used to predict the distribution of fish habitat in headwater streams. The presence or absence of fish habitat is the key resource concern that drives implementation of riparian buffer prescriptions. Other projects consist of studies designed to verify performance targets developed during FFR negotiations, such as the DFC basal area targets.

2.0 RULE GROUP DESCRIPTIONS AND MONITORING STRATEGIES

This section provides a rule group summary, rationale, strategy, and list of programs. The rule summary briefly describes the intent of the rule, the rationale identifies scientific questions related to those rules, and the strategy organizes those questions into programs and task categories.

2.1 RIPARIAN STRATEGY

The riparian strategy description is broken into five subgroups because of the complexity of this rule group. The subgroups are: the stream typing rule group (Type F/N delineation), the Type N rule group (non-fish-bearing streams), the Type F rule group, the Bull Trout rule group, and the Channel Migration Zone Rule Group. Each group is discussed separately below.

2.2 STREAM TYPING RULE GROUP

The FFR recommends adoption of rules by the forest practices board delineating waters of the state into three categories, Type S Waters, Type F waters and Type N waters. Distinguishing the upper limits of Type F (or S) waters is particularly important, because there are differences in the aquatic resources of concern, the management strategies and the prescriptions applied, depending on whether or not the stream provides fish habitat.

2.2.1 Rule Summary

Currently, stream typing is based on a complicated set of physical and beneficial use criteria according to guidance in the forest practice rules. Due to questions about the accuracy of this system, the FFR report recommends development of a statewide stream type map using a multi-parameter, field verified, GIS logistic regression model to identify the upper extent of Type F streams.

2.2.2 Strategy and Rationale

The FFR report provides a clear rationale and guidance for a strategy related to the stream typing system. The FFR report indicates that the current approach to stream typing is not adequately precise, defines a modeling approach for developing a new mapping, and sets specifications for the accuracy of the model. It also calls for development of a field protocol for inclusion in the forest practices board manual.

The Instream Scientific Advisory Group (ISAG) has developed a single program (the stream typing program) to develop and validate a GIS based model to predict the upstream extent of fish or fish habitat (Table 1).

Table 1. Stream typing rule group critical question and program.

Stream Typing Rule Group Critical Questions	Program Name	Task Type
How can the demarcation between fish-bearing and non-fish-bearing streams be accurately identified?	Stream Typing Program	Rule Tool

2.3 TYPE N RIPARIAN PRESCRIPTIONS RULE GROUP

Type N streams are non-fish-bearing streams that either do not provide suitable habitat to support fish or do not contain fish because of a natural barrier to fish migration. Type N streams are protected under FFR for several reasons. First, they provide habitat for stream-associated amphibians (SAA) covered by the agreement. Second, water quality standards pertaining to these streams need to be met. Finally, Type N streams contribute water, nutrients, woody debris, and sediment that affect downstream fish habitat and water quality.

The Type N riparian prescriptions are designed to accomplish the following FFR resource objectives:

1. Provide cool water by maintaining shade, groundwater temperature, flow, and other watershed processes controlling stream temperature),
2. Provide complex in- and near-stream habitat by recruiting large woody debris and litter,
3. Prevent the delivery of excessive sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,
4. Provide conditions that sustain SAA population viability within occupied sub basins

2.3.1 Rule Summary

There are two buffering strategies for Type Np streams, the clear-cut and the partial-cut strategies. The clear-cut strategy is prescribed for the west side, whereas landowners on the eastside have the flexibility to use either clear-cut or partial-cut strategies. The clear-cut strategy involves a patch buffering system where portions of the riparian stand can be clear-cut to the stream and other areas are protected with a 50-ft wide no-cut patch buffer. The patch buffer includes fixed and flexible components. Fixed components include 50-ft buffers around the sensitive sites (e.g., connected springs and seeps, Np initiation points; and stream junctions) and on both sides of the stream upstream 300-500 ft from the Type F/Type Np boundary. The flexible component allows the landowner to choose where to place the remaining buffer to bring the total buffer length to 50% of the Type-Np length. Eastside landowners have the option of using the 'partial-cut' strategy', a continuous 50 ft buffer along the length of the Type Np stream. The partial-cut buffer can be thinned, providing that the appropriate basal area and leave tree requirements are met. A 30 ft wide equipment limitation zone (ELZ) is established on all Type N streams (Np and Ni) to minimize sediment input from bank and soil disturbance. Operations within the ELZ are designed to avoid soil disturbance, and sediment delivery must be mitigated.

2.3.2 Strategy and Rationale

The Type N rules are based on the assumption that the riparian buffering strategies will result in aquatic conditions that meet the resource objectives and consequently achieve the three FFR performance goals. However, great uncertainty exists about these assumptions because the functional relationships between riparian management practices, riparian functions and aquatic resource response are not well studied or understood. Several major areas of uncertainty include:

1. How to identify the upper boundary of perennial flow in Type N streams,
2. How riparian stands and the inputs and functions they provide respond to management practices and the level of protection provided by the prescriptions,

3. The habitat utilization patterns of Stream Associated Amphibians and their response to riparian management practices, and
4. The effects of Type N riparian management practices on sediment, LWD, temperature and nutrient regimes in downstream fish-bearing streams.

The strategy for the Type N riparian prescriptions rule group is designed to address critical questions related to the effectiveness of the rules in achieving FFR goals and resource objectives. The critical questions, programs, task types and responsible SAG are listed in Table 2.

Table 2. Critical questions and programs for the Type N riparian prescriptions rule group.

Type N Riparian Prescriptions Rule Group Critical Questions	Program Name	Task Type	SAG
How should the initiation point of Type Np streams be identified for management purposes?	Type N Delineation Program	Rule Tool	UPSAG
How do survival and growth rates of riparian leave trees change following Type Np buffer treatments? Are riparian processes and functions provided by Type Np buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall? How do other buffers compare with the FFR Type N prescriptions in meeting resource objectives? Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives?	Type N Buffer Characteristics, Integrity and Function	Effective-ness	RSAG
Is Stream Associated Amphibian (SAAs) population viability maintained by the Type N prescriptions?	Type N Amphibian Response	Effective-ness	LWAG
Can the methods used to identify and characterize sensitive sites be improved?	Sensitive Site Program	Rule Tool	LWAG
Is the Type N riparian strategy effective in maintaining downstream fish habitat and harvestable fish populations?	Downstream Water Quality/Fish Response	Intensive	
What is the current status of riparian conditions and functions in Type N streams on a statewide scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type N)	Extensive	RSAG

2.4 TYPE F RIPARIAN PRESCRIPTIONS RULE GROUP

The Forest and Fish Report (FFR) recognizes differences in riparian systems and processes between eastern and western Washington. It describes the goal of the riparian strategies for Type F (fish-bearing) streams as follows:

> "…Riparian silvicultural treatments and conservation measures that are designed to result in riparian conditions on growth and yield trajectories towards what are called 'desired future conditions.' As used in this report, desired future conditions are the stand conditions of a mature riparian forest, agreed to be 140 years of age (the midpoint between 80 and 200 years) and the attainment of resource objectives. …These desired future conditions are a reference point on the

> pathway to restoration of riparian functions, not an endpoint of riparian stand development."

The eastern Washington riparian rules for Type F streams provide for stand conditions that vary over time within a range that emulates historic disturbance regimes, provides riparian functions needed to meet performance goals, and maintains forest health. Specified riparian functions include bank stability, wood recruitment, leaf litter fall, nutrients, sediment filtering, and shade. More specifically, the eastside rules were intended to create a range of stand characteristics within the riparian management areas that:

1. Fall within the range of historical variability,
2. Minimize risk of catastrophic events, and
3. Provide the functions that support the production of harvestable populations of salmonids.

It is assumed that riparian forests managed in accord with these strategies will provide adequate levels of key riparian functions to meet the overall performance goals for harvestable levels of salmonids, long term viability of amphibian populations, and the protection of water quality while maintaining a viable timber industry. The key functions include sediment, large wood, shade, and nutrients. These functions are the focus of the resource objectives and performance targets established for this rule group.

2.4.1 Rule Summary

The western Washington Type F riparian rules prescribe riparian buffers (riparian management zones or RMZs) equal in width to a site-potential tree height and are divided into three zones; core, inner, and outer. The core zone, closest to the stream, is 50 feet wide and generally is a no-harvest zone. The inner zone extends from 10 to 100 feet outside the core zone, depending on the site class and stream size. Several management strategies are allowed in the inner zone with the intent that the combined core and inner zone will be placed on a trajectory to grow into the desired future condition (DFC). The outer zone extends beyond the inner zone to the edge of the RMZ. The outer zone is managed to provide a variety of protections for special sites and wildlife habitat, while still contributing to the overall riparian functions provided by the RMZ. A variety of measures in the west side Type-F riparian rules address site-specific situations, operational concerns of landowners, conversion of hardwood-dominated sites to conifer, placement of large wood, catastrophic loss from fire or wind, and alternate plans.

The eastern Washington Type-F riparian rules require riparian buffers designed to provide the specified functions and meet the intent of the rule. Riparian management areas are divided into three zones, a core zone, an inner zone, and an outer zone. The core is a 30-foot wide no harvest zone that is intended to protect bank stability and maintain the majority of shade and wood recruitment. The inner zone is 45 to 70 feet wide and the outer zone is between 0 to 55 feet wide. The sum of the core zone, inner zone and outer zone approximates the length of a site-potential tree, which varies with site class. Allowable harvest within the inner and outer zones is different for each of three elevation bands, referred to as habitat types in the rules. These elevation bands were intended to emulate variations in natural disturbance regimes, variations in species distributions, and other riparian characteristics. Two temperature rules overlay the eastside rule package. The first defines the amount of shade needed to meet state water-quality

standards. The second (the bull trout overlay) is intended to provide the additional temperature protection required by bull trout (see Bull Trout Rule Group, below).

2.4.2 Strategy and Rationale

The western Washington Type F riparian rules are based upon the assumptions listed below:
1. The DFC basal area targets adequately describe mature riparian forest conditions.
2. The growth model used for DFC adequately projects riparian growth and mortality.
3. Some hardwood-dominated riparian stands need to be converted to conifer in order to achieve DFC.
4. Stands that meet the DFC target will provide the aquatic habitat conditions needed to provide the functions to meet the overall performance goals and resource objectives.

The eastern Washington Type F riparian rules are based upon the following assumptions:
1. The management strategies in the Type-F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2. The defined elevation bands are reasonably accurate reflections of the spatial distribution of historical disturbance regimes and species compositions
3. The management strategies will minimize risk of catastrophic events within the RMZs.
4. The management strategies will put stands on a trajectory that will provide the riparian functions needed to support harvestable populations of fish.
5. The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs of bull trout.

Uncertainties about the validity of the assumptions and the effectiveness of the rule lead to a series of critical questions and programs to address them (Table 3). They include: 1) the Type F Statewide Effectiveness Monitoring Program, which will address effectiveness of the Type F riparian rules in meeting performance targets and achieving resource objectives; 2) the hardwood conversion project, which will address uncertainty regarding strategies and prescriptions for managing hardwood dominated stands; 3) the Extensive Riparian Trend Monitoring, which will document status and trends of riparian conditions on Type F streams on a regional scale; and, 4) the DFC model validation, a rule tool program that addresses uncertainties regarding the validity of the west side DFC performance targets and the accuracy of DFC model that is used to project stand trajectory to age 140. The Eastside Riparian Type F Program will assess current riparian stand and stream conditions on Type F streams across the eastside, and evaluate the likelihood that the prescriptions will move stands towards desired future conditions (forest health, riparian function, and within historic disturbance regimes). It also will develop eastside LWD performance targets and validate the shade-temperature relationships for eastern Washington in the forest practices rules. One related program, the Bull Trout overlay temperature program, will address effectiveness of the eastside Type F shade requirements. This program is discussed in the Bull Trout rule group, below. Finally, the aquatic habitat-biotic response program addresses uncertainty concerning the response of aquatic organisms (e.g., fish populations) and their habitat to changes in riparian conditions and inputs. Design and implementation of this study is currently on hold pending further development of the intensive monitoring program.

Table 3. Critical questions and programs for the Type F riparian prescriptions rule group.

Type F Riparian Prescriptions Rule Group Critical Questions	Program Name	Task Type	SAG
Does the DFC model, including basal area targets, adequately describe mature riparian forests?	DFC Validation Program	Rule Tool	RSAG
Are the Type F riparian rules effective in meeting the performance targets, resource objectives, and overall performance goals of FFR?	Type F Statewide Effectiveness Monitoring Program	Effective-ness	RSAG
Where and how should hardwood conversion projects be conducted, and what are the ecological outcomes?	Hardwood Conversion Program	Effective-ness	RSAG
What is the current range of conditions for eastside riparian stands and streams? Will application of the prescriptions result in stands that achieve objectives eastside FFR riparian prescription objectives (forest health, riparian function and historic disturbance regimes)? What are appropriate LWD performance targets?	Eastside Type F Riparian Program	Rule Tool	SAGE
Can the shade/temperature relationships in the eastside temperature nomograph be refined?	Eastside Temperature Nomograph Program	Rule Tool	SAGE
What is the current status of riparian conditions and functions in Type F streams on a regional scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type F)	Extensive	RSAG
How do aquatic organisms respond to changes in habitat and water quality associated with changes in riparian inputs and functions?	Aquatic Habitat Biotic Response	Intensive	RSAG

2.5 BULL TROUT RULE GROUP

Bull Trout are listed under ESA as threatened throughout their range in Washington. A factor contributing to their "threatened" status is the degradation of habitat, especially increasing stream temperatures. Bull Trout temperature requirements are cooler than those of other salmonid species. The bull trout habitat overlay was developed to protect potentially suitable habitat for all life history stages of bull trout.

2.5.1 Rule Summary

Riparian timber harvest prescriptions in eastern Washington differ for streams located within or outside the bull trout habitat overlay area. When a timber harvest unit is located within the overlay, "all available shade" must be retained within 75 feet of the bankfull width or channel migration zone, whichever is greater. When outside the overlay, prescriptions fall under the standard shade rule, which can allow for harvest of a portion of shade trees within the 75 feet, depending on elevation and canopy cover existing prior to harvest. The standard shade rule, which targets earlier water quality temperature standards, is believed to be inadequate to meet the optimal bull trout water temperatures.

2.5.2 Strategy and Rationale

Problems arise during implementation of the bull trout overlay. Because knowledge of the current and potential distribution of the species is imprecise, large areas of forestland in eastern Washington are currently enveloped by the bull trout overlay. Some areas within the overlay may have never been occupied by bull trout and may not have the potential to support bull trout in the future, thus placing forestlands under inappropriate restrictions, resulting in riparian conditions that may not meet the intent of the eastside riparian strategy. Conversely, if neither the bull trout overlay nor the standard riparian prescriptions provide adequate stream temperature protection, other Forest and Fish goals will not be met.

The Bull Trout "All Available Shade" Rule is based on the following assumptions:

- Shade and water temperature are more at risk in eastern Washington than in western Washington because of the potential for more shade removal within the prescriptions and warmer air temperatures.
- The water temperature criteria within the current (prior to 2003) water quality standards (and nomographs) are too warm to meet the optimal cold water temperature needs of bull trout.
- A primary factor contributing to bull trout decline is habitat degradation, especially as it relates to stream temperature. Past forest practices, including shade removal, have been a contributing factor. Therefore with restoration of habitat and consequent reduction in stream temperatures, bull trout should rebound in those habitats.
- Historically when habitats were more optimal, watersheds were more extensively occupied by bull trout, including all life history strategies such as resident and migratory (i.e. fluvial and adfluvial).
- The bull trout habitat overlay includes areas that never have nor never will have the potential to support bull trout. Where this occurs, forestlands may be placed under inappropriate harvest restrictions.
- The "all available shade" rule should provide more shade and water temperature protection than the standard eastside prescriptions.
- The densiometer methodology can adequately measure and determine "all available shade".
- All shade affecting stream temperature comes from within 75 feet of the stream.

The following list of uncertainties apply to the bull trout "all available shade rule"

1. Lack of agreement on bull trout temperature requirements.
2. Different perspectives exist regarding the accuracy of the bull trout habitat overlay in identifying habitat potentially suitable for bull trout.
3. The characteristics of "unsuitable" bull trout habitat are poorly defined.
4. The effectiveness of the densiometer methodology for determining effective shade, especially "all available shade" is not fully accepted.
5. The meaning of "all available shade" is unclear.

The strategy for the bull trout rule group is intended to answer a set of critical questions that address these uncertainties (Table 4).

Table 4. Critical questions and programs for the Bull Trout rule group. All programs are administered by BTSAG.

Bull Trout Rule Group Critical Questions	Program Name	Task Type
Are both the standard eastside prescriptions and the "all available shade" rule effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature? Are FFR riparian prescriptions effective at protecting groundwater flow and temperature?	BTO Temperature Program	Effective-ness
How can habitat suitable for bull trout be identified?	Bull Trout Habitat Identification Program	Rule Tool

Two programs are proposed to address these questions. The Bull Trout Overlay Temperature Program is designed to address the effectiveness of FFR rules on shade and stream temperatures in bull trout habitat, as well as other eastside fish habitat. The Bull Trout Habitat Identification Program is identifying bull trout habitat for management purposes.

2.6 CHANNEL MIGRATION ZONE RULE GROUP

The channel migration zone (CMZ) is an area within a river or stream valley where the active channel is prone to move laterally. Channel movement in the CMZ can disturb adjacent vegetation potentially causing reductions in riparian function and associated habitat.

2.6.1 Rule Summary

The intent of the CMZ rule is to maintain riparian forest functions (e.g. woody debris recruitment, bank reinforcement, shade, and litter) along migrating channels. No timber harvest, salvage, or road construction (except for road crossings) is allowed within CMZs without an alternate plan that specifies the conditions which will provide equal and overall effectiveness of public resources as described in the rules and the Forest Practices Act.

2.6.2 Strategy and Rationale

The strategy for the CMZ rule group is intended to answer a set of critical questions that address uncertainties concerning CMZ delineation and effectiveness (Table 5). The overall strategy is to assess the delineation methods for CMZs while cooperating with the riparian rule group to develop and implement a long-term riparian/CMZ effectiveness-monitoring program.

Question 1 arises from the need to identify and delineate the CMZ so that the prescriptions can be implemented as intended. The rule assumes that the CMZ can be identified and the extent of the channel migration zone can be and will be consistently delineated by landowners. This assumption has high uncertainty because although many CMZs are relatively easy to recognize

locating the exact boundaries are difficult to define in the field. Incorrect delineation of the CMZ edge results in incorrect placement of the adjacent RMZ, making it vulnerable to channel disturbance.

Question 2 addresses whether areas prone to channel migration are predictable, which is based on the assumption that the area subject to channel migration during the last 100 years is the same that will be subject to channel migration during the next 100 years. There is a high level of uncertainty with this assumption because changes in land-use and other factors (i.e. in channel wood, sediment and flow) during the next 100 years could change the frequency of channel avulsion (the most common form of channel migration in forested conditions) leading to increased rates of migration.

Question 3 addresses the effectiveness of the CMZ rule in maintaining RMZ integrity and riparian functions. The rule assumes that riparian functions can be maintained by protecting forests in the CMZ and RMZ to provide riparian functions despite the effects of rapidly migrating channels. However, it is not clear that alternative plans will be equally successful because of a lack of information and experience on the part of landowners and regulators. Moreover, with changing forest practices it is uncertain that past migration patterns predict future migration and fluvial disturbance of the RMZ is likely. The CMZ rule group is divided into three programs addressing the critical questions.

Table 5. Critical questions and programs for the CMZ Rule Group. All effectiveness tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Channel Migration Zone Rule Group Critical Questions	Program Name	Task Type
What field/map criteria allow consistent, repeatable delineation of the CMZ lateral boundaries ("edge")?	CMZ Delineation Program	Rule Tool
Will the physical processes that drive channel migration change appreciably due to the application of FFR rules?	CMZ Validation Program	Effective-ness
Does the CMZ rule meet FFR performance goals and resource objectives?	CMZ Effectiveness Monitoring Program	Effective-ness

2.7 UNSTABLE SLOPES RULE GROUP

The FFR goal for unstable-slopes management is to prevent forest practices from increasing mass wasting (landslides) beyond the naturally occurring rate. The intent of the rule is to protect water quality and aquatic habitat by minimizing sediment delivery from forestry-related increases in mass wasting.

2.7.1 Rule Summary

The rule strategy begins with identification of unstable slopes. Once an unstable slope is identified, the strategy is either to avoid the area or conduct a risk evaluation through the SEPA process. The default protective measure for unstable slopes is avoidance. The rule strategy relies on the ability of forest managers to recognize and mitigate for unstable slopes within a forest practice application (FPA) and approval process. If forest practices are planned on

potentially unstable slopes, the application process requires SEPA review. The rule strategy depends on the correct identification and assessment of unstable slopes, which is achieved by defining unstable landforms at a statewide level in the rules and defining regional unstable landforms using local knowledge. A specific FFR rule relates to harvest on the groundwater recharge areas of deep-seated landslides in glacial sediments.

2.7.2 Strategy and Rationale

Table 6 presents a set of critical questions for the unstable slopes rule group and identifies a series of programs to address them. The strategy is to implement an unstable-landform identification program, to address critical questions 1 and 2, along with mass wasting effectiveness monitoring, and validation programs to assess the effectiveness of landform recognition and mitigation at various scales. All effectiveness, extensive, and intensive tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Table 6. Critical questions and programs for the Unstable Slopes Rule Group.

Unstable Slopes Rule Group Critical Questions	Program Name	Task Type
What screening tools can be developed to assist in the identification of potentially unstable landforms that minimize the omission of potentially unstable landforms?	Unstable Landform Identification Program	Rule Tool
Are deep-seated landslides in glacial sediments along with their recharge area being correctly and uniformly identified, and does harvesting of the recharge area promote their instability?	Glacial Deep-Seated Landslides Program	Rule Tool
Are unstable landforms being correctly and uniformly identified and evaluated for potential hazard?	Mass Wasting Effectiveness Monitoring Program	Effective-ness
What is the natural (background) rate of landsliding on managed forest lands?		
Are the FFR unstable-landform rules reducing the rate of management-induced landsliding at the landscape scale?		
Are the mass wasting prescriptions and mitigation measures effective in preventing landslides from roads and harvest units?		
What levels of cumulative sediment inputs are harmful to the resource at the basin scale?	Mass Wasting Validation Program	Intensive

2.8 ROADS RULE GROUP

The intent of the rules for roads is to protect water quality and riparian/aquatic habitat by minimizing sediment delivery and changes in hydrology due to roads. Fish passage at road crossing structures is treated as a separate rule group.

2.8.1 Rule Summary

The rules protect water quality and riparian/aquatic habitats through prescriptions and road Best Management Practices (BMPs). Implementation of prescriptions through the road maintenance and abandonment process (RMAP) should minimize road runoff and the connection between roads and streams. The road rules specify prescriptions for road construction, maintenance and

abandonment, landings, and stream-crossing structures. In addition, the Board Manual identifies BMPs for roads and landings. Beyond the site-specific limitations and BMPs, the rules require RMAPs for all forest roads to be developed within 5 years for large forest landowners, or timed with timber harvest activity for small forest landowners.

2.8.2 Strategy and Rationale

The basic assumptions of the road rules are

1. Implementation of road prescriptions will result in achieving FFR performance goals and resource objectives, including:
   a. Meeting water quality standards,
   b. Providing clean water and substrate and maintain channel forming processes by minimizing the delivery of management-induced coarse and fine sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,
   c. Maintaining surface and groundwater hydrologic regimes (magnitude, frequency, timing, and routing of stream flow). This will be accomplished by disconnecting road drainage from the stream network, preventing increases in peak flows causing scour, and maintaining the hydrologic continuity of wetlands.
2. Assessment and planning using RMAPs is the best method to assure effective implementation of BMPs and this will achieve the above objectives.
3. Roads differ in their degree and importance of impact to the resources of concern, and we can identify and prioritize roadwork based on these differences.
4. Appropriately identified standard BMPs are effective at achieving functional objectives.

Assessment of the rules leads to three sets of critical questions that direct the monitoring and research program. For roads, each question-set consists of a general main question that defines the program and several sub-questions that identify the research projects within the program. The three main questions are expressed in Table 7 along with the programs to address them.

The monitoring strategy began with basin-scale effectiveness monitoring and revision of the Road Surface Erosion model (WARSEM) in 2003. WARSEM is an essential effectiveness monitoring tool, as an earlier version of the model was used in the development of FFR road performance targets for sediment. The effectiveness-monitoring program includes both a site-scale component and a basin-scale component. Validation of the road performance targets, which is more complex and time-consuming, will come later. This approach will first inform the uncertainties about BMP effectiveness and their ability to meet FFR targets. If BMPs are ineffective, validation monitoring is unwarranted. If BMPs are proving to be effective, then validating the performance targets should begin (do we have the right target?). This approach is warranted by our long experience with road sediment problems and BMPs. The strategy for each program is described in the next chapter.

Table 7. Critical questions and programs for the Roads Rule Group.

Roads Rule Group Critical Questions	Program Name	Task Type
Does the RMAP process correctly identify priority fixes including orphan roads and fish passages (see Section 2.9)?	Road Effectiveness Monitoring Program	Effective-ness
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions which are covered under the Mass Wasting Rule Group).		
Are road prescriptions effective at meeting site-scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions, which are covered in the Mass Wasting Rule Group section).		
Have the correct performance targets for sediment delivery and connectivity been identified?		
What levels of cumulative sediment inputs are harmful to the resource at the basin scale? (Validation of road sediment targets).	Roads Validation Program and Cumulative Sediment Effects.	Intensive

2.9 FISH PASSAGE RULE GROUP

The intent (objective) of the fish passage rule is to install, upgrade and/or maintain stream crossings by 2016 that provide fish passage at all life stages.

2.9.1 Rule Summary

Fish passage blockages at road crossing structures are to be addressed as part of the road maintenance and abandonment plan (RMAP) process. Road crossing structures will be inventoried, evaluated and prioritized during the RMAP planning process. Those structures that do not provide fish passage will be repaired or replaced within 15 years, typically on a "worst-first" basis. WDFW's hydraulic code rules, the associated barrier-assessment manual, and DNR's forest practices rules apply to crossing structures on forest roads.

2.9.2 Strategy and Rationale

Critical questions were developed through an analysis of the FFR rules during which the assumptions and uncertainties underlying the rule were identified. From these uncertainties, two critical questions were derived (Table 8). The fish passage rule is based on the following assumptions:

1. Achieving the objective is critical for recovery of depressed stocks and the health of all fish at all life stages.
2. Implementation of the rules will result in achieving the objective to maintain or provide passage for fish in all life stages and to provide for the passage of woody debris likely to be encountered.
3. Assessment, prioritization, and implementation of RMAPs will achieve the objectives in a timely manner.

4. Current stream crossing replacement standards are adequate to address all fish and life history stages.
5. Hydraulic code criteria are effective at achieving resource objectives.
6. Fish species and life history stage distributions can be characterized statewide.
7. Performance targets have not been developed for fish at all life history stages.
8. Assessment of hydraulic swimming capabilities of lesser-understood species/life stages is achievable within 15 years.
9. Assessment of movement patterns of lesser-understood species/life stages in highly variable stream systems is achievable within 15 years.
10. Stream simulation methods provide passage for all fish and life history stages.

Table 8. Critical questions and programs for the Fish Passage Rule Group.

Fish Passage Rule Group Critical Questions	Program Name	Task Type
Are the corrective measures effective in restoring fish passage?	Fish Passage Effectiveness Monitoring Program	Effective-ness
What is the current status of fish passage on a regional scale, and how are conditions changing over time?	Extensive Fish Passage Monitoring Program	Extensive

2.10 PESTICIDES RULE GROUP

The objectives of the pesticides rule group is to manage pesticide use to achieve water quality standards, meet label requirements, and avoid harm to riparian vegetation. In the context of the forest practices rules pesticide means "any insecticide, herbicide, fungicide or rodenticide, but does not include nontoxic repellents or other forest chemicals."

2.10.1 Rule Summary

The pesticide rules include a series of regulations that cover: 1) aerial application of pesticides, 2) ground application of pesticides with power equipment, and 3) hand application of pesticides. The rules for aerial application of pesticides prescribe a setback (offset) to prevent application of pesticides within the core and inner zones of Type F and S streams, or the wetland management zone (WMZ) of Type A or B wetlands. In these cases the offset is from the outer edge of the inner zone or the WMZ. Offsets are also prescribed for flowing Type N streams and Type B wetlands < 5 acres, however in these cases the offsets are measured from the edge of the bankfull channel or wetland. The offset distances vary depending on water type; the type of nozzle used, and wind conditions at the time of application. Separate guidelines govern ground application of pesticides with power equipment and hand equipment within RMZs and WMZs.

2.10.2 Strategy and Rationale

The main assumption is that the pesticide rules will be effective in achieving the objectives of meeting water quality standards, label requirements and preventing damage to vegetation in RMZs and WMZs. There is some level of uncertainty about this, particularly in the case of aerial application due to potential difficulties due to terrain and wind conditions. A single critical question has been developed, with a corresponding effectiveness program (Table 9).

Table 9. Critical questions and programs for the Pesticides Rule Group.

Pesticides Rule Group Critical Questions	Program Name	Task Type
Do the pesticide rules protect water quality and vegetation within the core and inner zones of Type S and F RMZs or the WMZs of Type A or B wetlands?	Forest Chemicals Program	Effective-ness

2.11 WETLAND PROTECTION RULE GROUP

Wetland adaptive management goals are identified in the FFR report as:

> "The goal … is to clarify the mapping of wetlands and provide for an assessment of the functions of associated wetlands. This is intended to include an assessment of the functions served by forested wetlands and the potential impacts of harvest activities in forested wetlands. The assessment may include the determination of harvest activities that cannot be adequately mitigated or recovered. Where such assessments suggest that changes in forest practices are required, this Appendix is intended to provide the mechanism for the consideration of additional rules for the protection of such wetlands."

The intent of the wetland rules is to achieve no net loss of wetland function (water quality, water quantity, fish and wildlife habitat, and timber production) by avoiding, minimizing, or preventing sediment delivery and hydrologic disruption from roads, timber harvest, and timber yarding. The main strategy is to use forest and fish rules and watershed analyses as the primary vehicle for implementing wetland BMPs.

2.11.1 Rule Summary

The forest practices rules classify wetlands into two categories. Type A wetlands include non-forested wetlands greater than 0.5 acres in size or forested wetlands and non-forested bogs greater than 0.25 acres. Type B wetlands included non-forest wetlands greater than 0.25 acres in size. Landowners are required to inventory and map wetlands as part of the FPA for timber harvest or road construction. Wetland management zones (WMZ) are prescribed for all Type A wetlands and Type B wetlands greater than 0.5 acres. The WMZs have variable widths based on the wetland type and size. The specific leave tree requirements within WMZs differ for eastern and western Washington. There are also restrictions on the use of ground based harvesting equipment within WMZs. Within forested wetlands, harvest methods are limited to low impact harvest or cable systems and landowners are encouraged to leave a portion of the wildlife reserve tree requirement within the wetland. Additional rules apply to road construction to assure that there is no net loss of wetland function. The preferred option in the guidance is to prevent impacts by selecting road locations outside of wetlands, however where that is not possible, the guidelines seek to minimize and mitigate impacts.

2.11.2 Strategy and Rationale

The wetland rules are based on the following assumptions:

1. Implementation of the wetland prescriptions will result in achieving no net loss of wetland functions over a timber rotation, assuming that some wetland functions may be reduced until the mid-point of a timber rotation cycle.
2. Assessment and planning in watershed analysis and implementation of forest practices rules will achieve the stated resource objectives.
3. Appropriately identified, standard BMPs are effective at achieving the resource objectives.
4. Forested wetlands will successfully regenerate following timber harvest.

There is uncertainty whether these assumptions are valid. Furthermore, the wetland functions listed in the rules are limited and significant uncertainty exists regarding their adequacy to meet the resource objectives of the FFR report. The degree to which current rules for wetland mitigation will achieve the "no net loss of wetland function" policy is unclear. No objective performance measures are available for determining the:

1. Range of wetland functions affected by road construction, harvest and harvest methods or
2. Net loss or gain of these functions over time.

These assumptions and uncertainties guided development of critical questions and research and monitoring programs to address them (Table 10).

Table 10. Critical questions and programs for the Wetlands Rule Group. .

Wetlands Rule Group Critical Questions	Program Name	Task Type
Are forested wetlands regenerating sufficiently to maintain wetland functions?	Wetlands Revegetation Effectiveness Program	Effective-ness
Are road construction activities, harvest and harvest methods adequately mitigated to achieve no net-loss of wetland functions?	Wetland Mitigation Program	Effective-ness
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids? Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams? Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	WMZ Effectiveness Monitoring Program	Effective-ness
How should wetlands be classified and mapped for management purposes?	Wetland Tools Program	Rule Tool

The rule strategy for wetlands is to establish through a comprehensive literature review the current scientific basis for evaluating wetland functional relationships with salmonids, covered species and water quality and quantity. The literature review will be followed by development of tools that show wetland locations (GIS Layer) and functions (Hydro-geomorphic HGM classification system). Specific effectiveness/validation studies will be developed to answer specific questions about the effects of rule implementation at the landscape and site scales.

2.12 WILDLIFE RULE GROUP

Although the FFR agreement is focused on water quality, fish, and SAAs, CMER has funded a number of other wildlife research projects since the late 1980s. These projects have addressed both general, multi-species, state-wide issues, as well as species specific concerns about the effects of forest practices. Both the Policy Committee and CMER have acknowledged that wildlife issues are important and need attention and are currently funding additional sampling and analyses of a study that examines wildlife use of two streamside buffer designs. However, the focus of CMER is currently on FFR priorities and the only CMER funding for other wildlife would be from the State general funds.

2.12.1 Rule Summary

Forest practice rules directed at wildlife conservation have taken 2 approaches: 1) general state-wide requirements, and 2) species specific strategies. In addition, several other rules may benefit wildlife through the retention or enhancement of habitat, such as riparian buffers, upland management areas, landslide hazard zonation, etc. The only general state-wide rule specifically directed at wildlife conservation is the provisions for wildlife reserve tree management (WAC 222-30-020[11]). Specifications for the retention of wildlife reserve trees, green recruitment trees, and down logs are provided for both eastern and western Washington. Species specific forest practice rules are closely tied to both state and federal endangered and threatened species programs. Under forest practices, the habitat of listed species is defined as critical habitat (state) and any proposed activity in critical habitat becomes a Class-IV Special forest practice under SEPA (WAC 222-10-040), requiring consultation, evaluation, an environmental impact statement, and mitigation. There are currently 10 species for which these rules apply, e.g., the bald eagle (*Haliaeetus leucocephalus*), grizzly bear (*Ursus arctos*), northern spotted owl (*Strix occidentalis*), and marbled murrelet (*Brachyramphus marmoratus*).

Another species specific approach that avoids the need for direct rule making that has been endorsed by the Forest Practices Board is the development and adoption of management plans or the specification of "voluntary" guidelines. The federal listing of the lynx (*Lynx canadensis*) prompted the state and a few large private landowners in northeastern Washington to develop and adopt a lynx management plan. The state listing of the western gray squirrel (*Sciurus griseus*) resulted in landowners agreeing to apply forest practice guidelines developed by the Washington Department of Fish and Wildlife in areas known to contain the species.

These rules and associated guidelines can become very complex. Each species generates specific definitions of habitats, specific monitoring methods, and specific provisions for protection of sites that vary with the species needs. In addition, the Forest Practices Board often adopts rule options that allow landowners to develop species specific management plans.

2.12.2 Strategy and Rationale

The Landscape and Wildlife Advisory Group (LWAG) has been developing an overall wildlife work plan for several years. However, focused plan development for wildlife issues other than those associated with FFR were delayed until the FFR work plan is completed. Nonetheless, LWAG continues to work on the broader work plan as issues and time allows. To date, LWAG has identified subprograms that contain several issues, each with critical questions (Table 11).

Table 11. Wildlife issues (in order of priority) and critical questions that are addressed by LWAG in different forums.

Wildlife Rule Group Critical Questions	Program Name	Task Type
What are the values of snags retained in upland management units and RMZs? Is there a threshold response by wildlife to snag density? What are the fates of wildlife reserve trees (WRT) and green recruitment trees (GRT) in managed forests? What are the most-effective ways of retaining and replacing snags?	Effectiveness of snags for wildlife	Effectiveness, Validation
What are the effects of variation in stand establishment practices, herbicides, thinning, fertilization, and rotation lengths on vegetation and wildlife? Does the concept of the steady-state shifting mosaic apply and how does that process effect wildlife?	Conifer management effects on wildlife	Validation, Effectiveness
What role do RMZs, UMAs, and other forest patches play in maintaining species and providing structural and vegetative characteristics thought to be important to wildlife? What are the functions of large legacy trees (snags, down wood, high stumps) as compared to the smaller complements produced in intensively managed forests? What are the roles and fates of special sites (e.g., rock outcrops, cliffs, talus slopes, isolated small wetlands, etc.) in managed forests?	Legacy features and their effect on wildlife	Effectiveness, Validation
What are the movement patterns, processes, and distances of amphibians in managed forests? Do amphibians persist in refugia following timber harvest or is subsequent occupancy related to movements from other areas? How quickly do amphibians re-colonize areas, particularly habitat outside the stream network? What is the role of ponds created by beaver, slumps, rotational failures, road ditches, and sediment traps, and off-channel habitats in the distribution and abundance of still-water breeding amphibians?	Amphibian movement and distribution effectiveness monitoring	Effectiveness
What is the status and trends of bats in managed forests?	Forest Bats	Extensive
What is the role of WRTs and GRTs in bat ecology? What are the relationships between forest management and bat foraging and roosting?	Forest Bats	Effectiveness
What is the relationship between the abundance and productivity of wildlife and gradients in the composition and structure of ponderosa pine stands?	Ponderosa Pine Habitat	Effectiveness
What are the effects of forest practices on the western gray squirrel and oviposition sites of egg-laying reptiles? What is the role of isolated oak trees and small patches of oaks? What are the appropriate management approaches to maintaining and restoring oak woodlands at stand and landscape levels?	Oak woodland Habitat	Effectiveness

3.0 PROGRAM DESCRIPTIONS

This section describes the purpose and research strategy for each program by task category. The program description is intended to include the identification of specific projects that will be implemented to address critical questions. Depending on the research priorities (see Section 4), projects may or may not be defined at this time. Eventually, over time, all projects and the rationale for conducting the projects will be included in the program descriptions.

3.1 EFFECTIVENESS MONITORING PROGRAMS

3.1.1 Type N Buffer Characteristics, Integrity and Function Program

Purpose

The purpose of this program is to evaluate the FFR Type N riparian management prescriptions, including the composition, growth and mortality of buffer trees, the level of riparian functions they provide, the biotic and water quality responses to the prescriptions, and their effectiveness in achieving performance targets and meeting water quality standards.

Type N prescriptions are highly uncertain because they are based on many assumptions that have not been adequately studied or validated. This program addresses the major Type-N assumptions / uncertainties by focusing on four critical questions.

1. How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?
2. Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?
3. What riparian protections measures are needed to meet resource objectives and performance standards?
4. Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?

Strategy

The effectiveness of the Type N prescriptions are uncertain because there are many gaps in the scientific understanding of headwater streams, the aquatic resources they support, and the response to different management strategies. Consequently, the prescriptions are based on many assumptions that have not been thoroughly studied or validated. This program addresses several major assumptions / uncertainties that have been incorporated into a series of critical questions. Table 12 lists the critical questions and identifies projects designed to address them. The highest priority projects address the effectiveness of the FFR Type N prescriptions. Several approaches are used to address this complex issue. The Type N FFR Buffer Integrity, Characteristics and Function Project will provide data on a random sample of FFR Type N buffers from approved applications to evaluate prescription performance over the range of conditions across the FFR landscape. Type N Experimental Buffer Treatments Project will evaluate FFR Type N buffers by comparing them with a series of alternative buffer treatments in paired-basin experimental setting. This study will focus on quantifying resource responses of Type N buffers that require

intensive sampling and a controlled experimental design, including amphibian response, litter fall, temperature and downstream exports. The DNR Type 5 experimental buffer treatment project is a cooperative study with DNR and USFS of experimental buffers in very small headwater streams which will also provide information and experience in monitoring small streams. Participation in this study will provide useful information on the response of this class of streams to a range of treatments and the experienced gained will help in the design the other experimental buffer treatment project. The Type N performance target validation project is needed to test and refine FFR performance targets for Type N riparian prescriptions. Data on the response of buffers, the level of riparian functions provided and aquatic resource response gained from the three buffer effectiveness projects will be used to help define and design this project at a future date. The Type N classification project is currently a concept that remains to be scoped and developed.

Table 12. Type N Buffer Characteristics, Integrity and Function Program.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?	Type N FFR Buffer Integrity, Characteristics and Function Project
Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?	Type N Buffer Integrity, Characteristics and Function Project Type N Experimental Buffer Treatments Project
How do different buffering strategies compare with the FFR Type N prescriptions in meeting resource objectives?	Type N Experimental Buffer Treatments Project
Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?	Type N Performance Target Validation Project
Do different types of Type N channels explain the variability in the response of Type N channels to forest practices?	Type N Classification Project

Project Descriptions

Type N Buffer Integrity, Characteristics and Function Project (Table 25, line 4)

The Type-N FFR buffer integrity, characteristics, and function project will evaluate the effectiveness of the FFR Type-N riparian prescriptions, including survival of buffer leave trees, stand condition and trajectory over time, and changes in riparian functions including shade, LWD recruitment, and stream bank protection. Randomly sampling Type N forest practices and pairing the "treatment" sites with un-harvested control sites will provide an unbiased estimate of variability for the performance of the buffers relative to the Type N performance targets. The design for this project has been approved and funded by CMER. Initial post-harvest sampling at 15 treatment control pairs in the western Washington western hemlock zone strata was initiated in the fall of 2003. RSAG intends to begin sampling on the eastside in 2004.

DNR Type 5 Experimental Buffer Treatment Project (Table 25, line 5)

This is a cooperative project with DNR and USFS that compares the response of riparian stands, temperature, litter fall, nutrients, small mammals, amphibians, and downed wood to a range of buffer treatments applied in sets of small paired watersheds. This design provides the high level

of control needed to distinguish differences in response to variations in buffer treatments. This information, in combination with the results from the buffer integrity, characteristics, and function study, is essential for understanding how effective the different elements of the FFR prescriptions are for resource protection. Baseline data collection is underway, with harvests scheduled to begin in the fall of 2003. CMER provided funding to assist with baseline data collection in the summer of 2003.

Type N Experimental Buffer Treatment Project (Table 25, line 6 and 7)

A draft study plan for this project is being developed in the fall of 2003. LWAG is taking the lead on developing the study plan, with assistance from BTSAG, RSAG and UPSAG. As currently envisioned, this study will be designed to compare the effect of several different alternative Type N buffer treatments with an untreated control. The study design will involve establishing several blocks, consisting of adjacent type N basins where the various treatments and control are applied. Data on variables such as amphibian populations, riparian stand characteristics, tree mortality and LWD recruitment, shade and stream temperature, litter fall, light, stream flow, water chemistry, particulate and invertebrate export and stream bank erosion and compared with pre-harvest baseline data to document change. The study design was submitted to CMER in the fall of 2003

Type N Performance Target Validation Project (Table 25, line 8)

The Type N Performance Target Validation Project will probably consist of one or more studies designed to validate the relationships between Type N performance targets and aquatic resource response. This comparison will ensure that the performance targets provide a meaningful indication that FFR resource objectives are being achieved. Scoping for this project has not occurred.

Type N Classification Project (Table 25, line 9)

The Type N Classification Project will explore potential methods of classifying Type N streams to provide a context for interpreting channel response to management practices. The project will identify important physical processes that affect the results of the above projects, the findings of the N Amphibian Response programs and contribute to the integration of Type N functions and processes.

3.1.2 Type N Amphibian Response Program

Purpose

The purpose of this program is to addresses critical questions concerning the response of SAAs to forest practices, particularly the Type N riparian prescriptions. Many uncertainties exist regarding the distribution of SAAs, their life history and habitat utilization patterns, population dynamics, effects of forest practices on SAA habitats, and the response of SAA populations to these changes. Consequently, the Type N riparian rule is based on many assumptions, particularly that buffering portions of perennial Type N streams, i.e. a set of 'sensitive' sites thought to provide high quality SAA habitat, will maintain the viability of SAA populations. These assumptions and uncertainties have been examined and used to develop a series of sub-questions under the main critical question (Table 13).

Table 13. Type N Amphibian Response Program.

Critical Questions	Project
Is SAA population viability maintained by the Type N prescriptions? Do SAAs continue to occupy and reproduce in the patch buffers? Do SAAs continue to occupy and reproduce in the ELZ only reaches? If SAAs do not continue to occupy the ELZ only reaches, do they re-occupy those reaches before the next harvest? How does SAA habitat respond to the sensitive site buffers? How does SAA habitat respond to variation in inputs, e.g. sediment, litter fall, wood? How do SAA populations respond to the Type N prescriptions over time?	SAA Detection/ Relative Abundance Methodology Project Type N Experimental Buffer Treatment
What are the common findings and inconsistencies in published studies on the effects of timber harvest on tailed frogs? What can be learned from a meta-analysis of published data and unpublished data on tailed frogs in managed forests?	Tailed Frog Literature Review & Meta-analysis Project
What are the common findings and inconsistencies in published studies on the effects of timber harvest on tailed frogs? What can be learned from a meta-analysis of published data and unpublished data on tailed frogs in managed forests	Dunn's & Van Dyke's Salamander Project
What are the effects of various levels of shade retention on the stream-breeding SAAs? Is there an optimum level of shade retention? Does territoriality in high quality habitat confound interpretation of SAA relative abundance estimates?	Buffer Integrity-Shade Effectiveness Project
What are the effects of 3 buffer treatments on SAAs, 2 years post-harvest?	Amphibian Recovery Project

Strategy

This program began with the development of tools needed to implement the Type N buffer rule for SAA sensitive sites (i.e., SAA sensitive sites identification methods and characterization) and to conduct all 3 types of monitoring (i.e., SAA detection/relative abundance methodology). Following the completion of these projects extensive, effectiveness, and intensive monitoring will begin in conjunction with other CMER programs where possible. During tool development other projects designed to determine critical monitoring questions for some species (i.e., tailed frog literature review and meta-analysis) or answer species specific L-1 questions were undertaken (i.e., Dunn's and Van Dyke's salamanders).

Due to variation in SAA distribution and abundance it was determined that an extensive monitoring project for SAAs would not provide useful information for the FFR adaptive management program. Furthermore, designing a meaningful effectiveness/validation monitoring program for SAAs that fit within the Type N Buffer Characteristics, Integrity, and Function Project was not possible given the sampling scheme and the distribution of SAAs in Washington.

Due to those factors, it was necessary to design a monitoring program that focused on SAA distribution and physical factors (e.g., geology) that appear to effect SAA distribution, abundance, and response to timber harvest (i.e., the Type N Experimental Buffer Treatment Project). RSAG and UPSAG also developed monitoring pieces that fit within this framework for water quality, riparian and in-stream habitat, and sediment. Rather than simply monitor the Type N prescription, this project takes an experimental approach where various buffer types and configurations will be evaluated that will enhance adaptive management and validate some of the assumptions behind the Type N buffer strategy.

Project Descriptions

SAA Detection/Relative Abundance Methodology Project (Table 25, line 16)

The SAA Detection/Relative Abundance Methodology Project is currently underway. It is designed to evaluate and develop a standard methodology for sampling SAAs in headwater forest streams. It addresses the need for a research/monitoring methodology to detect amphibians and determine their relative abundance. The most widely used methods produce high variance estimates and detection probabilities are unknown. The project should be completed before future SAA research projects are initiated.

Tailed Frog Literature Review & Meta-analysis Project (Table 25, line 17)

Of the 6 FFR SAAs, the tailed frog may be the most extensively studied due to an inclusive distribution in the coastal Pacific Northwest. There are enough published studies on this species that a synthesis of those results will be useful in helping LWAG develop a research and monitoring program. In addition, those data sets, as well as several that are not published, will be the subject of a meta-analysis. That analysis may or may not support the literature review synthesis and will likely identify other factors related to tailed frog distribution and response to timber harvest that will be useful in developing LWAG's program. The literature review has been completed and the meta-analysis is underway.

Dunn's & Van Dyke's Salamander Project (Table 25, line 18)

The FFR indicates that LWD may be important for Dunn's and Van Dyke's salamanders. However, general habitat descriptions for both these species emphasize the importance of stream side rocky substrates. The first part of this project was to conduct a literature review to determine the basis for the LWD connection for these species in the FFR. The next phase of the project was to conduct a study designed to provide additional information on the role of LWD in these species habitats. Both phases have been completed.

Buffer Integrity-Shade Effectiveness Project (Table 25, line 20)

The effects of blow down on SAAs in Type N patch buffers are largely unknown. However, blow down is unpredictable in time and space, precluding a passive monitoring approach. One of the primary effects of blown down is a reduction in shade. This project will examine the effects of 4 levels of shade retention on tailed frog and torrent salamander density, body condition, and spatial distribution, water temperature, primary productivity, and macro invertebrates. This is a cooperative project between Longview Fibre Company and Washington Department of Fish and Wildlife. Longview Fibre is conducting the study within the range on the Columbia and Cascades torrent salamanders and WDFW within the range of the Olympic torrent salamander. Tailed frogs are also found within the range of all 3 torrent salamanders. Longview Fibre began a pilot study in 2003.

Amphibian Recovery Project (Table 25, line 21)

In 1998, the National Council for Air and Stream Improvement (NCASI) funded a study by Dr. Rhett Jackson on the effects of 3 buffer treatments on headwater streams in the Willapa Hills and Olympic Peninsula. Many of the FFR SAAs occurred on these sites. The NCASI funding covered a year of pre-treatment data and immediate post-harvest sampling. This project collected additional data, 2 years post-harvest. This project was completed in 2003.

3.1.3 Type F Statewide Prescription Monitoring Program

Purpose

The purpose of this program is to undertake research and monitoring to evaluate the effectiveness of the FFR Type F riparian prescriptions, compare and evaluate alternative Type F buffer treatments, and to validate the Type F performance targets. The program is designed to address scientific uncertainty about the prescriptions for type F streams, including:

1. The survival of buffer trees and rates of buffer tree mortality from wind-throw, disease, insects and other factors,
2. Post-harvest changes in conifer-dominated Westside RMZs, and whether Westside stands will remain on trajectory to achieve DFC performance targets,
3. Post-harvest changes in conifer-dominated eastside RMZs, and whether eastside riparian stands will remain within desired ranges and
4. Uncertainty about the level of riparian functions provided by riparian stands produced by FFR Type F prescriptions, and whether or not FFR resource objectives and performance targets will be achieved.
5. The efficacy of alternative buffer designs in providing riparian functions and meeting resource objectives and performance targets.
6. The validity of various performance targets.

Strategy

Implementation of the Type F statewide prescription monitoring program was identified as a priority by CMER in the January 2003 program ranking process. The program is designed to answer a series of critical questions that will help reduce scientific uncertainty concerning the effectiveness of the Type F prescriptions and the response of riparian stands, functions and aquatic resources to riparian management practices. Table 14 lists the critical questions and the projects that address them.

The program will be implemented in a staged fashion. The Type F riparian prescription monitoring project will be the first project to be implemented, because the most pressing uncertainties concern the effectiveness of the current FFR Type F prescriptions. Depending on the results of this project, a second project may be implemented to test the effectiveness of alternative buffer designs (the Type F experimental buffer treatment project). Finally, the response of aquatic organisms and resources to different levels of riparian inputs and functions needs to be examined to determine if the Type F performance targets are valid and meaningful measures (Type F Performance Target Validation Project).

Table 14. Type F Statewide Prescription Monitoring Program critical questions and projects.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR Type F buffer treatments?	Type F Riparian Prescription Monitoring Project
Do stands in Type F RMZs remain on trajectory to DFC (west side) or within desired ranges (east side)?	
Do riparian functions meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall following application of the riparian Type F prescriptions?	
Would alternative approaches to the FFR Type F prescriptions be more effective in meeting FFR resource objectives and performance targets, while reducing costs or increasing flexibility for landowners?	Type F Experimental Buffer Treatment Project
Are the Type F performance targets valid and meaningful measures of success in meeting resource objectives?	Type F Performance Target Validation Project

Project Descriptions

Type F Riparian Prescription Monitoring Project (Table 25, line 27 and 28)

In January of 2003, CMER approved the N/F Riparian Prescription Monitoring study design, which included a study design for monitoring the effectiveness of the Type F riparian prescriptions. RSAG has decided to implement the Type F riparian prescription effectiveness monitoring project in stages, beginning with the eastside. RSAG, in conjunction with BTSAG and SAGE, is currently developing a proposal to conduct eastside Type F effectiveness monitoring at paired treatment control sites used for the Bull Trout Overlay temperature study.

Type F Experimental Buffer Treatment Project (Table 25, line 29)

The Experimental Type F Buffer Treatment Project has not been scoped or designed. This project will be designed after information on the effectiveness of the current FFR prescriptions is available from the results of the Type F riparian prescription monitoring project. This information will be used to identify appropriate alternative prescriptions to test.

Type F Performance Target Validation Project (Table 25, line 30)

Scoping for the Type F Performance Target Validation Project has not occurred.

3.1.4 Hardwood Conversion Program

Purpose

The purpose of this program is to inform the FFR strategy for addressing legacy effects of past timber harvest. Many riparian stands in areas where conifer stands formerly occurred are currently dominated by hardwoods as a result of post logging practices and probably won't achieve DFC without active intervention. Large uncertainties exist concerning the identification of locations where hardwood conversion is an appropriate management strategy, the cost and effectiveness of different silvicultural techniques, and the trade-offs between short-term effects and long-term benefits.

Strategy

Table 15 presents the critical questions and projects of the Hardwood Conversion Program. The program consists of one project, the Hardwood Conversion Project, which is underway.

Table 15. Hardwood Conversion Program critical questions and projects.

Critical Questions	Project
How effective are different hardwood conversion treatments in re-establishing conifers in hardwood-dominated riparian stands?	Hardwood Conversion Project
Is hardwood conversion in riparian stands operationally feasible and what are the economic costs and benefits of the hardwood conversion treatments?	
What effects do hardwood conversion treatments in riparian stands have on shade, stream temperature and LWD recruitment?	

Project Description

Hardwood Conversion Project (Table 25, line 51)

The Hardwood Conversion Project is a series of case studies of landowner designed and implemented site-specific harvest of hardwood trees in riparian buffers followed be replanting of conifers. Pre- and post-conversion monitoring will document the effects on instream and riparian habitat measures and on regeneration success. In addition, RSAG is contemplating other projects to address aspects of hardwood conversion, such as studies to determine how to identify sites where hardwood conversion is an appropriate management strategy, and to assess the distribution and characteristics of hardwood-dominated riparian stands on FFR lands.

3.1.5 Bull Trout Overlay Temperature Program

Purpose

This program addresses the effectiveness of eastside FFR rules in meeting shade and temperature requirements for fish habitat.

Strategy

The Bull Trout Temperature Overlay (BTO) Program consists of three projects that address the critical questions in Table 16. The projects are designed to compliment each other by first determining the available shade to Bull Trout streams and the effectiveness of that shade in achieving/maintaining the desired water temperature and then by determining the effect of ground water inputs on stream temperatures.

Table 16. BTO Temperature Program.

Critical Questions	Projects
Are stream temperatures associated with the Bull Trout overlay shade requirements suitable to meet Bull Trout resource objectives? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature?	BTO Temperature Project
Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule?	Solar Radiation/Effective Shade Project
Does timber harvest affect the temperature of groundwater entering streams?5	Groundwater Conceptual Model Project

Project Descriptions

BTO Temperature Project (Table 25, line 37)

The BTO Temperature Project is designed to evaluate the effectiveness of both the "all available shade" rule and the standard eastside riparian prescriptions in meeting FFR resource objectives, and to determine if there is a difference in shade and stream temperature provided by the BTO prescriptions and the standard shade requirements. This is a field study that is administered by BTSAG and is currently in the site-selection and pre-harvest data collection stage. It is combined with the Solar Radiation /Effective Shade Project.

Solar Radiation/Effective Shade Project (Table 25, line 38)

The Solar Radiation/Effective Shade Project is designed to evaluate whether "all available shade" is actually achieved under the BTO shade rule. This study is in the site selection and pre-harvest data collection stage.

Groundwater Conceptual Model Project (Table 25, line 39)

The on-going Groundwater Conceptual Model Project is designed to investigate the potential impacts of timber harvest on groundwater temperatures, which subsequently can discharge to streams and thereby affect the temperature regime of fish habitat. A literature review has been completed and a conceptual model is being developed to identify areas that are highly susceptible to groundwater heating after timber harvest.

Groundwater Research Studies (Table 25, line 40)

These projects have not been scoped.

3.1.6 CMZ Effectiveness Monitoring Program

Purpose

The channel migration zone (CMZ) program addresses two Critical Questions:

1. Does the CMZ rule meet FFR resource and functional objectives by:
   a. Protecting trees subject to recruitment as a result of channel migration?
   b. Protecting off-channel aquatic resources?
   c. Providing adequate LWD and shade to the channel?
   d. Maintaining natural rate of sediment input from banks?
2. Are riparian processes and functions being maintained in alternate plans for CMZ protection?
   a. What are the riparian processes and functions provided by the CMZ that must be maintained in alternate plans?
   b. Do riparian functions and processes vary regionally?
   c. What short- and long-term changes in riparian processes should be considered acceptable in the development/approval of alternate plans?

Strategy

Effectiveness monitoring of CMZ functions (Questions 1b through 1d) has a low uncertainty because the rule provides full protection of the CMZ. The uncertainty is greater for the correct delineation of the CMZ and hence the degree of protection provided to the RMZ (Question 1a) and for the effectiveness of alternate plans in maintaining CMZ riparian functions (Question 2). The effectiveness-monitoring program addresses these uncertainties through three projects.

Project Descriptions

CMZ Function Assessment Project (Table 25, line 59)

A literature review of off-channel and riparian functions and physical processes provided by CMZs. This project has been neither scoped nor designed.

CMZ Integrity Monitoring Project (Table 25, line 60)

This project is a retrospective study of existing CMZs to assess their integrity and the degree to which the CMZ and RMZ have been impacted by lateral migration. This project has been neither scoped nor designed.

CMZ Alternate Plan Assessment Project (Table 25, line 61)

Monitoring CMZs with alternate plans to assess the degree to which off-channel and riparian functions have been preserved. This project has been neither scoped nor designed.

3.1.7 Mass Wasting Effectiveness Monitoring Program

Purpose

The purpose of this program is to assess the degree to which implementation of the FFR rules is preventing or avoiding an increase landsliding beyond natural background levels. The rules assume that:

1. The administrative process of identifying, reviewing, and regulating forest practices on potentially unstable slopes will maintain a naturally occurring rate of mass wasting following forest practices.
2. Implementation of the unstable slopes prescriptions will achieve the Schedule L-1 Resource Objectives of clean water and substrate and maintain channel-forming processes.
3. Implementation of the unstable slopes prescriptions will meet FFR landscape-scale targets (there are no site-scale targets).

Strategy

The Mass Wasting Effectiveness Program will address the critical question that defines the program: *"Are the mass-wasting prescriptions effective in meeting the performance targets?"* The strategy is to 1) evaluate effectiveness of identifying unstable slopes for applying prescriptions (avoidance or mitigation), and then 2) to evaluate effectiveness at two scales, the landscape scale (Extensive Monitoring) and the site scale (prescription monitoring). Landscape-scale monitoring will evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis. Site-scale or prescription level monitoring will use a "post-mortem" analysis on a sample of landslides to determine if and how management actions were responsible for triggering the landslide. This will include landslides associated with roads, harvest, and/or leave areas (e.g., wind throw-triggered). We will coordinate the two scales of monitoring by conducting prescription level "post-mortems" within watersheds evaluated in the landscape-scale monitoring. This will allow for interpretation of results across multiple scales; i.e., how does the effectiveness (or ineffectiveness) of specific prescriptions contribute to the total effect of landslides at the landscape scale? There are currently two competing and/or complimentary monitoring designs for extensive monitoring for mass wasting under consideration by the UPSA. Evaluation of these designs from current and planned pilot projects is expected to be completed

by 2004. Table 17 lists critical questions identified for mass wasting effectiveness monitoring and the associated projects.

Table 17. Mass Wasting Effectiveness Monitoring Program.

Critical Questions	Project
Are unstable landforms being accurately and consistently identified in the field?	Effectiveness of Unstable Landform Identification Project
Are forest practices preventing or avoiding an increase in landsliding beyond natural rates of mass wasting?	Mass Wasting Landscape-Scale Effectiveness Monitoring Project
What field protocols will be used for assessing the causal mechanism of landslides at the site scale? Are unstable slope rule strategies failing to prevent landslides, and if so, how?	Mass Wasting Prescription-scale Effectiveness Monitoring Project
Does wind-throw on mass-wasting buffers (leave areas) increase mass wasting?	Mass wasting buffer Integrity and Wind-throw Assessment Project

Project Descriptions

Effectiveness of Unstable Landform Identification Project (Table 25, line 32)

Considerable variability and bias exists between investigators when determining hazard areas associated with unstable (e.g., high-risk) landforms. The extent of this variability and/or bias, and how much influence it may have on accurately identifying hazards in the field are unknown. This study will a) consider approaches to test the extent of accuracy and bias in slope hazard identification, specifically

1) Are unstable slopes currently being uniformly recognized?
2) Are some unstable slopes currently going unrecognized?
3) Is the hazard of unstable slopes being correctly and uniformly recognized?

This study will provide recommended improvements to reduce variability related to proper hazard identification and assessment.

Mass Wasting Landscape-Scale Effectiveness Monitoring Project (Table 25, line 35)

This project will be designed to evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis. In broad terms, monitoring for trends will occur among a selection of sites that sample statewide variability in the factors that control landslide occurrence. These sites will consist of tracts containing both FFR-regulated lands and other lands under no or less extensive management (representative of natural or background conditions). Landslide rates and volume fluxes from both will be compared. Data to infer status and trends will consist of an inventory of landslides using aerial photography, terrain, topographic, forest cover, and road network maps. The current status will be assessed using existing data, monitoring for trends will require collection of additional data over time for each site.

Mass Wasting Prescription-Scale Effectiveness Monitoring Project (Table 25, line 33)

This project will be designed to conduct prescription level monitoring of landslides in FFR-compliant units to determine if and how management actions were responsible for triggering the landslide. This study will include landslides associated with roads, harvest, and leave areas, to

determine the effectiveness of the current management strategies (typically avoidance) on preventing landslides. This project will help validate the effectiveness monitoring project (and vice versa).

Mass Wasting Buffer Integrity and Wind throw Assessment Project (Table 25, line 34)

This project will be designed to test the effect of wind throw in mass wasting leave areas on overall landslide rates. There is a school of thought that suggests that mass wasting leave areas are especially prone to wind throw. If that is true, then mass wasting leave areas would be counter-productive for reducing sediment load to streams.

3.1.8 Roads Basin-Scale Effectiveness Monitoring Program

Purpose

The purpose of the roads effectiveness monitoring program is to determine the degree to which road prescriptions are effective at meeting performance targets for sediment and water.

Strategy

The effectiveness monitoring program for roads exists at two scales: 1) monitoring at the sub-basin scale and, 2) monitoring at the site scale. FFR performance targets have been established at the sub-basin scale and provisions were made to develop site-scale performance measures. At the sub-basin-scale, road monitoring assesses the effectiveness of the rule strategy for roads at meeting the FFR performance targets for sediment in run off and hydrologic connectivity and whether implementation of the rules is attaining the performance targets across ownerships and regions of the state. This program assumes that performance targets are correct, which allows the testing of effectiveness against those targets. Because the rules provide for a 15-year implementation window for new road rules, this is a long-term program and results will provide a periodic evaluation of the trend and whether that trajectory is toward meeting the performance targets by 2016.

Site-scale effectiveness monitoring provides more immediate insights into the effectiveness of road prescriptions. Because the FFR prescriptions are tied to implementation of RMAPs, monitoring must also occur within this context. The site-scale subprogram requires the development of site-specific road performance measures (based on prescription objectives), the testing of site-level effectiveness using RMAP areas as a sampling stratum, and the development of field protocols for site-scale performance measures. The road site-scale effectiveness monitoring program will inform the rules at several levels by determining whether strategies for achieving resource objectives are working at the site scale, whether individual RMAPs need to be modified to achieve resource objectives, , and if the guidelines and rules for road maintenance and abandonment planning need to be changed.

The road prescription effectiveness monitoring program currently consists of five projects, and Table 18 relates the program's projects to critical questions. Two tools or methods need development to support the monitoring program. Two projects revise and validate an analytical model to estimate road-surface erosion (the Watershed Analysis road surface erosion model) needed to estimate sediment contributions from selected road segments and road systems. While the prescription monitoring focuses on the effectiveness of prescriptions applied to targeted sites

and locations, the second project listed in Table 18 asks if we are first correctly targeting the appropriate locations to fix according to the priorities established in the rules.

Table 18. Road Rule Effectiveness Monitoring Program.

Critical Program Questions	Projects
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water?	Road Sub-Basin-Scale Effectiveness Monitoring Project
Are RMAP scheduled activities identified and prioritized appropriately?	Effectiveness of Identifying RMAP Priority Fixes Project
Are field or analytical methods needed to support the monitoring program?	Road Surface Erosion Model Update Project
Are road prescriptions effective at meeting site-scale performance targets for sediment and water?	Road Prescription (Site-Scale) Effectiveness Monitoring Project
How accurate is the road surface erosion model in predicting average road sediment from run off at the site scale?	Road Surface Erosion Model Validation/ Refinement project

Project Descriptions

Road Sub-Basin-Scale Effectiveness Monitoring Project (Table 25, line 23)

The main purpose of this project is to provide data that can be used to assess the degree to which sub-basin scale performance targets, and therefore resource objectives, are being met throughout the state. Data collected at the sub-basin scale will determine the status and assess trends of key indicators of road connectivity and sediment delivery through time. It does not address performance targets for road performance relative to mass wasting erosion processes, which are more readily evaluated through other monitoring projects. Forest road systems to be monitored will be in randomly selected sample areas distributed statewide in areas under FFR rules, independent of ownership. Data collected are those needed to determine if roads meet established performance targets and to determine if there is a relationship between those reported measures and the percent of sample area under implemented RMAPs. Fifteen years is the projected minimum time frame for monitoring road-related performance targets due to the implementation schedule of new road maintenance and abandonment rules. Because road monitoring at the sub-basin scale is expected to extend the 15 year length of the road rule implementation period, this piece will be put in place first. A draft monitoring design is currently under review by the CMER members.

Road Surface Erosion Model Update Project (Table 25, line 24)

The road surface erosion model within the Surface Erosion Module of the Washington Forest Practices Board Manual on Standard Methodology for Conducting Watershed Analysis (version 4.0, November 1997) is an empirically-derived model widely used for estimating surface erosion and sediment delivery to streams from forest roads. The primary purpose of this project is to develop the model for use as a monitoring tool. Revisions are needed to update and refine the model for use as both a forest road monitoring and an assessment method. Revisions include standardizing input variables and developing repeatable application protocols. This project also

includes development, testing, and refinement of standardized protocols for field application of the revised road surface erosion model for use at the site and road segment scale. Final products are expected from the contractor before the end of 2003.

Road Surface Erosion Model Validation/Refinement Project (Table 25, line 25)

The Washington State road surface erosion model (WARSEM) is based on empirically-derived data. This project will build on that data for factors within the model identified as needing more data during the model update project listed above. This will also provide an opportunity to add to and update the model relationships from on-going academic and industry sponsored data collection. The scope of work or study plan for this work has not yet been initiated.

3.1.9 Roads Prescription (Site-Scale) Effectiveness Monitoring Program

Project Descriptions

Effectiveness of Identifying RMAP Priority Fixes Project (Table 25, line 48)

A separate question related to road effectiveness monitoring is whether maintenance activities targeted in the RMAPs have been appropriately identified and prioritized based on rule language aimed at protecting resources by fixing the "worst first." Monitoring this aspect of the prescription strategy for roads is important because we may determine that individual or collective prescriptions are effective in meeting resource protection goals based on a site scale criteria, but if they are not applied to the right locations the net benefit to the resource is lost or less effective and at some cost to the landowner.

The primary purpose of this project is to evaluate if RMAP priorities have been identified and scheduled appropriately. The project will audit a random sample of RMAPs state wide, and audit results will be used to inform the rules and guidelines related to how RMAP activities are scheduled. Work on developing the study design has not yet been started, but will be initiated as soon as the basin scale monitoring implementation begins.

Road Prescription (Site-Scale) Effectiveness Monitoring Project (Table 25, line 49)

Monitoring of forest roads at the prescription scale has several main objectives: evaluate the effectiveness of road prescriptions in meeting site-scale sediment performance targets, and identify sensitive situations where prescriptions are not effective. The focus of site-scale effectiveness monitoring is on RMAPs, both individual and collectively. Where treatments are found not to meet site-specific performance targets, site data is analyzed for cause, further evaluation, or alternative treatment options. These sites may be candidates for BMP investigations, testing or refinement assuming no compliance or installation problems. Results from site-scale monitoring can be provided within a short time frame of 2-4 years, and this project will be conducted in parallel with the basin scale road monitoring project. A draft monitoring plan is in progress, but no completion date has been estimated.

3.1.10 Fish Passage Effectiveness Monitoring Program

Purpose

This program is designed to address uncertainties in the WDFW hydraulic code rules, associated barrier-assessment manual, and road maintenance and abandonment plans that may decrease the effectiveness of fish passages at forest road-crossing structures (Table 19).

Table 19. Fish Passage Effectiveness Monitoring Program.

Critical Questions	Project
Are the corrective measures effective in restoring fish passage?	Fish Passage Effectiveness Monitoring Project

Strategy

ISAG has developed Policy questions that will provide greater focus on the intent of FFR regarding fish passage monitoring. After Policy guidance is obtained, ISAG will draft an RFP in spring or early summer, 2004.

Project Description

Fish Passage Effectiveness Monitoring Project (Table 25, line 53)

This project has been neither scoped nor designed.

3.1.11 Forest Chemicals Program

Purpose

The purpose of this program is to address uncertainty concerning the effectiveness of the chemical application rules in protecting water quality and vegetation in riparian and wetland buffers. Alterative strategies with lower costs will also be considered.

Strategy

The program is under RSAG. This project assigned a low priority in CMER's January 2003 program prioritization process (Table 25, line 63). Scoping has not occurred and no projects have been identified.

3.1.12 Wetlands Re-vegetation Effectiveness Monitoring Program

Purpose

This program addresses uncertainty concerning the re-vegetation of forested wetlands following timber harvest. Critical questions and the associated projects are listed in Table 20.

Strategy

Schedule L-1 of the FFR states a key performance target for wetlands is "no net loss in the hydrologic functions of wetlands". Schedule L-2 H.9 directs the testing of the performance target from L-1 through research to "assess the hydrologic functions of forested wetlands, the effects of

harvesting on stream flows and the effectiveness of prescriptions in meeting wetland targets." Among the list of issues is the evaluation of the regeneration and recovery capacity of forested wetlands. A literature review and synthesis of forested wetlands was performed to identify current understanding of forested wetland functions and regeneration capabilities in the Pacific Northwest. The review and synthesis also identified informational gaps that will be used to identify further research considerations. A pilot project to evaluate methods for determining reforestation in forested wetlands is underway and will be followed by a study to determine the regeneration and recovery capacity of forested wetlands after timber harvest. Future studies of wetland and stream temperature interactions and hydrologic connectivity will further explore wetland functions and impacts associated with timber harvest.

Table 20. Forested Wetlands Re-vegetation Effectiveness Program.

Critical Questions	Project
What is currently known about regeneration in forested wetlands in the Pacific Northwest and what are the information gaps? What is currently known about affects of timber harvest on forested wetland functions?	Forested Wetlands Literature Review & Workshop project
What are the current methods of evaluating regeneration in forested wetlands and how successfully are they being implemented? What results are landowners experiencing? What kind of guidance can be given to landowners to best ensure regeneration of forested wetlands? How does the stand compare in composition post harvest to pre-harvest conditions? How are forested wetland functions affected by timber harvest?	Statewide Forested Wetland Regeneration Pilot & Project
Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams?	Wetland/Stream Water Temperature Interactions Project
Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	Wetland Hydrology Connectivity Project

Project Descriptions

Forested Wetlands Literature Review and Workshop Project (Table 25, line 42)

This project is nearly completed. It has undergone CMER and SRC review. The comments received are now being reviewed and edited by WSAG. The project is scheduled to be completed by July 2004.

Statewide Forested Wetland Regeneration Pilot and Project (Table 25, line 43 and 44)

The pilot project is currently underway and is in the site reconnaissance phase. The results of the pilot are scheduled to be published in late 2004 or early 2005. The main project is scheduled to begin in 2005.

Wetland/Stream Water Temperature Interactions Project (Table 25, line 45)

This project has been neither scoped nor designed. This project is not scheduled until 2008.

Wetland Hydrologic Connectivity Project (Table 25, line 46)

This project has been neither scoped nor designed. This project is not scheduled to begin until 2007.

3.1.13 Wetland Mitigation Program

Purpose

Current forest practice rules require mitigation for filling of wetlands and replacement of lost wetland functions. Currently no information on the effectiveness or compliance of these requirements is available. .

Strategy

Critical questions and projects are listed in Table 21. To address the performance target of "no net loss of hydrologic functions of wetlands", Schedule L-2 H.8 sets a goal to determine "wetland size and function requiring mitigation sequencing to achieve targets". This program will evaluate whether wetland mitigation projects are being conducted as required by the forest practices rules, and where conducted, if they are successful in achieving their stated goals and objectives and replacing lost wetland functions caused by wetland filling. This information can then be used to recommend any needed changes to the current process of wetland mitigation.

Table 21. Wetlands Mitigation Program.

Critical Questions	Project
Is wetland mitigation being performed when required by the forest practice rules? Are wetland mitigation projects achieving their stated goals and objectives? Are wetland mitigation projects replacing lost wetland functions? What functions are not being replaced?	Wetland Mitigation Effectiveness Project

Project Description

Wetland Mitigation Effectiveness Project (Table 25, line 52)

The project will entail reviewing projects that involved the filling of wetlands due to road or landing construction. It will be determined if mitigation was required. Field evaluation of the sites will be conducted [what parameters will be collecting?] The project is scheduled to begin by June 2004.

3.1.14 Wetland Management Zone Effectiveness Monitoring Program

Purpose

This program will be designed to assess the effectiveness of Wetland Management Zones in meeting FFR resource objectives and performance targets. The wetland management zone rules are based on a number of assumptions, including:

1. Meeting the wetland performance targets will achieve the functional objectives.
2. Certain BMPs work better than others.
3. We can determine how effective BMPs are (to a generalized degree). We can standardize how we measure and document this effectiveness.
4. Reaching BMP objectives at the site scale (i.e., avoiding road fill in wetlands) will aggregate to meeting sub-basin and watershed scale functional objectives.

These uncertainties form the basis for the critical questions (Table 22) that the program will be designed to address.

Strategy

Scoping to develop a strategy will begin in late 2004.

Table 22. Wetland Management Zone Effectiveness Monitoring Program.

Critical Questions	Project
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids?	Wetland Management Zone Effectiveness Monitoring Project

Project Description

Wetland Management Zone Effectiveness Monitoring Project (Table 25, line 57)

This project has been neither scoped nor designed. This project is not scheduled to begin until 2006.

3.1.15 Wildlife Program

RMZ Study Resample Project (Table 25, line 55 and 56)

In 1990, CMER funded an experimental study that examined the effects of 2 buffer configurations (state regulations and "smart buffers") on birds, small mammals and amphibians. That study included 2 years pre- and post-harvest data and a final report was completed in 2000. Generally, the results were species specific and equivocal, which raised numerous questions about the long-term response of wildlife to the treatments. Due to these questions, the fact that the smart buffer was similar to the FFR buffer for Type F streams, data on riparian conditions was collected, some SAAs were sampled, and 5+ years had elapsed since the last sampling, another 2 years of sampling was initiated in FY 2003. The project is scheduled for completion in FY 2006.

Ponderosa Pine Habitat (not in FFR budget)

A number of bird species are thought to be closely associated with mature Ponderosa pine forest. Currently, Ponderosa pine forests occur along a gradient from dense stands of Douglas-fir and grand fir with a few large remnant pines to low density open stands composed almost exclusively of large diameter pine. This project would examine the abundance of birds along this gradient on the east slope of the Cascade Mountains.

Other Wildlife Programs/Projects (not in FFR budget)

Due to the overriding importance of the FFR adaptive management program, funds for the Wildlife Program from CMER are limited and confined to those from the State General Fund. Due to these circumstances, none of the other programs in Table 11 have been developed into specific projects.

3.2 EXTENSIVE MONITORING PROGRAMS

Extensive monitoring evaluates the current statewide status and future trends of key watershed input processes and habitat conditions across FFR lands. Extensive monitoring is a landscape-scale assessment of the effectiveness of FFR rules to attain specific performance targets. This is different from prescription effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide annual or periodic report-card-type measure of rule effectiveness (i.e., do we meet the performance targets or how much have we improved over time) that can be used to by the regulatory agencies to determine if progress is consistent with expectations. Several extensive monitoring components were identified in the MDT report. CMER has identified several extensive monitoring programs, but further scoping and project design is needed, as well as CMER review and approval.

Mass wasting and roads rule groups are not included in the extensive monitoring program. Landscape-scale monitoring for mass wasting and roads does not lend itself to quick, report-card-type measures of rule effectiveness. Monitoring in these rule groups requires more involved, data-intensive and field work-intensive studies, such as complete landslide inventories linked with storm and management histories, and detailed road inventories linked to road surface erosion modeling, and tracking of BMP implementation over time. For this reason mass wasting and roads landscape-scale monitoring is incorporated into their respective effectiveness monitoring programs

3.2.1 Extensive Riparian Trend Monitoring Program

The purpose of this program is to obtain an unbiased estimate of the distribution of stream temperature, shade, and riparian stand characteristics across FFR lands.

Strategy

A study design for the extensive riparian trend monitoring program is currently being developed by RSAG. The program will address a set of critical questions concerning the current status and future trends of riparian stand characteristics and related stream habitat conditions on FFR lands. Sampling will be stratified by region (eastside and west side) and by stream type (Type F and Type N). The program will be implemented in stages by sampling stratum. Since site selection requires accurate information on the location and typing of streams, RSAG plans to begin sampling on the west side because the western Washington stream typing model is expected to be available in 2004. Once the eastern Washington version of the stream typing model is complete, sampling can begin on the eastside.

Project Description

Extensive Riparian Trend Monitoring Project (Table 25, line 67 and 68)
Scoping for this project is currently underway.

3.2.2 Extensive Fish Passage Trend Monitoring Program

This program will be designed to evaluate status and trends in fish passage conditions at forest road crossings. A draft study design was developed as an attachment to the MDT report and is

currently under review by ISAG. If alternative strategies to the MDT design are not advanced and approved by ISAG before January, then the MDT design will be adopted.

Project Description

Extensive Fish Passage Trend Monitoring Project (Table 25, line 69)

Anticipating that ISAG will use the MDT sampling design, refined sampling strategies, including sample sizes and locations, will be developed in coordination with EPA's E-MAP crew before March 2004. ISAG will develop an RFP to collect data before April 2004. Fieldwork is anticipated beginning in late June 2004.

3.2.3 Extensive Wetlands Trend Monitoring Program

The wetlands extensive monitoring program will assess the status and trends of reforestation of forested wetlands harvested under FFR rules.

Strategy

This project requires that the wetland database project be complete. The database is listed under rule tools and is under the prevue of the DNR. The wetlands database project is not scheduled to begin until 2006.

Project Description

Extensive Wetlands Trend Monitoring Project (Table 25, line 70)

Scoping to develop a strategy has not occurred. Projects are currently proposed to begin in 2009 or 2010.

3.3 INTENSIVE MONITORING PROGRAM

Intensive monitoring is a watershed-scale research program that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR on aquatic resources. The evaluation of cumulative effects of multiple management actions on a system requires an understanding of how individual actions influence a site and how those responses propagate through the system. This understanding will enable the evaluation of the effectiveness of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. This program was identified in the MDT report as an essential component of an integrated monitoring program. The scientific advisory groups have identified several research topics that appear suitable to include as part of an intensive monitoring program (Table 25, line 73). Further scoping is underway to identify critical questions and hypotheses for intensive monitoring.

3.4 RULE IMPLEMENTATION TOOL PROGRAMS

Rule implementation tool programs/projects are designed to develop, refine or validate tools used to implement the forest practices rules. Two types of rule-tool projects are recognized:

1. Methodology Tool Development Projects develop, test or refine protocols, models, and guides that allow the identification and location of FFR specified management features, such as the Last Fish Model, various landslide screens, the Np/Ns break and SAA Sensitive Site Identification.
2. Target Verification Projects consist of studies designed to verify the validity of performance targets developed during FFR negotiations that the authors identified as having a weak scientific foundation, such as the DFC basal area targets.

Rule implementation tools differ from research and monitoring tools, which are required to implement a specific effectiveness-monitoring program, such as Road Surface Erosion Model. Monitoring implementation tools are included with the effectiveness monitoring programs.

3.4.1 Type N Delineation Program

The purpose of this program is to validate and refine methodologies for identifying the perennial initiation point (upper extent of perennial flow in Type N streams). The program is administered by UPSAG. The pilot project is completed and part of the adaptive management process. The second phase is anticipated to begin in 2006.

Project Descriptions

Perennial Stream Survey Pilot (Type N Stream Demarcation Study): (Table 25, line 96)

The pilot project produce a field methodology for identifying the break between seasonal flow (Ns streams) and perennial flow (Np streams), provided an initial assessment of the accuracy of the default basin area numbers, identified alternative default criteria, and developed an estimate of the sample size needed to achieve precision and accuracy objectives based on variability in basin areas above the Np/Ns break.

Perennial Stream Survey (Type N Stream Demarcation Study): (Table 25, line 97)

A statewide project that will refine/develop default criteria and possible field criteria that can be used to identify the Np/Ns break in the field. Design and implementation of this project is contingent on policy direction but initiation of some form of type N stream demarcation study is anticipated in 2006.

3.4.2 Sensitive Site Program

This program consists of two rule-tool implementation projects. Work on the program began in 1999. It is managed by LWAG.

Project Descriptions

SAA Sensitive Sites Identification Methods Project (Table 25, line 99)

The purpose of the SAA sensitive site identification method project is to develop a practical methodology for identifying SAA sensitive sites, such as headwall seeps, side-slope seeps, and headwater springs. It is designed to answer the following critical questions:

- Are sites important to amphibians correctly identified by rule?
- Are rule-identified sites valuable for amphibians?
- Does sensitive site field identification need to be improved?

It is intended to inform the Type N riparian rule by providing a standard methodology (field guide) for field managers to identify SAA sensitive sites when designing harvest units. This project is currently underway and is being administered by LWAG.

SAA Sensitive Sites Characterization (Table 25, line 19)

The purposes of this project are to document the distribution and characteristics of sensitive sites as described by the FFR rule and to verify their utilization and habitat value for SAA. It will generate information on the characteristics of sensitive sites, validate the extent to which they are utilized by amphibians, and determine if other sensitive sites exist. Information from this project could result in changes to the sensitive area criteria in the rules to better focus buffer protection on areas important to SAA. This project is currently underway and is being administered by LWAG.

3.4.3 Stream Typing Program

ISAG and DNR Forest Practices Division staff administers this program.

Project Descriptions

Last Fish/Habitat Prediction Model Development Project (Table 25, line 101)

The purpose of this project is to develop a GIS-based logistic regression fish habitat model(s) to identify and map the upper boundary of Type F (fish-bearing) streams. This project will inform the stream-typing rule by providing the consistent, statewide mapping system required by the FFR agreement. This project is currently underway. A preliminary model for western Washington is nearly completed, and work on eastern Washington is scheduled to begin in late 2003.

Annual/Seasonal Variability Project (Table 25, line 103)

Seasonal and annual variability will be characterized to understand how modeled points vary with time. A seasonal variability study will be drafted and reviewed by SRC in late 2003, and field studies will be conducted by season in 2004 and early 2005.

Last Fish/Habitat Prediction Model Update & Validation (Table 25, line 102)

This project objective is validation and assessment of model predictions to accurately evaluate model performance and future applicability. It will include developing a field validation study design to examine the predictive performance of the water type model across watersheds of western Washington; and developing an approach and method to investigate the performance of the model in correctly determining fish presence, fish absence, and fish habitat.

Guidelines for Field Protocol to Locate Mapped Divisions (Table 25, line 104)

Protocols and methods with be developed and proposed for adopting in the Forest Practices Board Manual Section 23. Through the Validation study protocols and methods will be tested and evaluated to establish a recommendation for the Forest Practices Board.

3.4.4 Type F DFC Validation Program

Purpose

The purpose of this program is to address issues related to validation of the western Washington DFC performance targets for conifer and mixed riparian stands on Type F streams. The program is being administered by RSAG. This program is designed to address uncertainties about the DFC approach, including uncertainties about: 1) how well the current targets reflect mature unmanaged riparian conditions for conifer and mixed stands, 2) how accurately the DFC model predicts growth of riparian stands to age 140, 3) what sort of habitat conditions will be provided by mature riparian stands, and 4) how young stands of different composition and density develop as they mature.

Strategy

This program consists of several projects designed to answer a series of critical questions (Table 23). DFC target validation has been identified as a high priority issue. To manage conifer and mixed riparian stands to achieve functions associated with mature stands, the DFC approach requires stand targets that reflect mature stand conditions, and a model that can accurately predict the trajectory of young stands to maturity. Validation of the DFC performance targets is a high priority. Work on the DFC target validation project began in 2000, and the project results are undergoing CMER review as of the fall of 2003. Validation of the DFC model is another high priority project. Work on the study design for this project was put on hold while RSAG waited to see whether the regional riparian stand growth-mortality cooperative effort proposed by the UW would be able to address this issue in a cost-effective manner. The DFC-Aquatic Habitat Project is a lower priority issue, consequently scoping on this project has not begun. The Pathways of Riparian Stand Development to Maturity Project is an outgrowth of the DFC target validation project, based on the realization that many young low density stands of mixed composition are not likely to achieve DFC without some form of intervention, and that a better understanding of the development of such stands is need to identify appropriate management approaches.

Table 23. Type F DFC Validation Program critical questions and issues.

Critical Questions	Projects
Do the DFC targets accurately reflect stand conditions for mature, unmanaged conifer-dominated west side riparian stands?	DFC Target Validation Project
Does the DFC growth and mortality model accurately predict the trajectory of west side conifer-dominated riparian stands to age 140?	DFC Trajectory Model Validation Project
What aquatic habitat conditions are associated with mature west side riparian stands?	DFC-Aquatic Habitat Project
How do mature stand structures develop from younger stands in a variety of stand compositions and densities?	Pathways of Riparian Stand Development to Maturity Project
What growth trajectories and successional pathways are characteristic of hardwood-dominated riparian stands?	Red Alder Growth and Yield Model Project

Project Descriptions

DFC Target Validation Project (Table 25, line 106)

The purpose of this project is to collect data on stand characteristics from a random sample of mature unmanaged conifer-dominated riparian stands in western Washington, compare basal area per acre from the sample with the current DFC targets, and evaluate alternative parameters for characterizing DFC. A pilot project was completed in 2001. Sampling for the main study was completed in the summer of 2002 and a draft project report is currently undergoing CMER review. A proposal to conduct additional sampling to characterize the age distribution trees and the level of regeneration in the DFC stands is being developed for implementation in 2004.

DFC Trajectory Model Validation Project (Table 25, line 107)

This project will assess the accuracy of the DFC model in predicting riparian stand growth and trajectory from harvest age to the DFC target (age 140). This project will be designed to validate the DFC model as a tool to predict trajectory to the DFC target for both conifer-dominated and mixed stands. A study design has not been developed for this project because RSAG is waiting to see if a regional riparian stand cooperative effort is a viable approach to address this issue.

DFC-Aquatic Habitat Project (Table 25, line 108)

The purpose of this project is to determine the range of aquatic habitat associated with mature (DFC) riparian forest conditions. A study design for this project has not been developed.

Pathways of Riparian Stand Development to Maturity Project

The purpose of this project is to determine how mature stands develop from younger stands of various compositions and densities, including implications for management of uneven-aged stands and those of low density or mixed composition. Scoping for this project has not occurred.

Red Alder Growth and Yield Model Project (project development, Table 25, line 148)

The purpose of this project is to develop a growth and yield model for red alder. Existing models either do not include red alder amongst the species simulated or use equations that are based on very little actual data. In this project, cooperators from across the PNW contribute existing data that will be compiled and cleaned at the UW Stand Management Cooperative. A growth and yield model for red alder will developed from these data in a second phase of this project. Red alder is a dominant component of many riparian forests and while the model developed is not specific to riparian areas it will provide better information on the growth dynamics of these riparian stands then is currently available. CMER has contributed money but no data to this cooperative effort. This project is currently underway.

3.4.5 Eastside Temperature Nomograph Program

Project Descriptions

Eastside Temperature Nomograph Project (Table 25, line 109)

The purpose of this project is to update and validate the shade-elevation-stream temperature relationships in the eastside temperature requirements nomograph. This project is currently underway and is being administered by SAGE.

3.4.6 Bull Trout Habitat Identification Program

This program is administered by BTSAG and consists of two projects.

Project Descriptions

Bull Trout Presence/Absence Protocols (Table 25, line 111)

This active project is developing a set of protocols for assessing the presence of Bull Trout.

Bull Trout Habitat Prediction Models (Table 25, line 112)

This project will be designed to improve the accuracy of the method used to identify Bull Trout habitat for forest management purposes.

Yakima River Radiotelemetry (Table 25, line 113)

This active project is designed to evaluate the migratory patterns of bull trout and to identify their distribution and habitat preferences in the Yakima River watershed. The information gained from this project will inform bull trout presence/absence protocols and habitat prediction models.

3.4.7 CMZ Delineation Program

This program will develop materials and procedures to aid field managers in the consistent and accurate delineation of CMZs. The program is being administered by UPSAG. It consists of two projects.

Project Descriptions

CMZ Screen and Aerial Photograph Catalog Project (Table 25, line 128)

This GIS-based project will be designed to identify potential CMZs based on slope and valley width data and to overlay on this map the historic DNR aerial photographs documenting past migration behavior.

CMZ Boundary Identification Criteria Project (Table 25, line 129)

This project will be designed to develop criteria and a consistent and uniform method to define the margins (edges) of the CMZ.

3.4.8 Unstable Landform Identification Program

This program consists of five projects that provide statewide information on the distribution of unstable landforms. The management strategy for regulating forest practices on unstable slopes consists primarily of an administrative process for identifying and reviewing forest practices on potentially unstable slopes. The main elements include defining and screening unstable slopes and improvements to the State Environmental Protection Act (SEPA) process. The success of the management strategy for unstable slopes is dependent on our ability to recognize potentially unstable slopes in order to avoid or mitigate the hazards posed from operating on these landforms. The projects in this program are specifically referenced in the FFR as necessary for implementing forest practices that meet resource objectives. This program is administered by UPSAG.

Project Descriptions

Shallow Rapid Landslide Screen for GIS (Table 25, line 115)

The first phase of this project developed a GIS-based screen of modeled slope stability based on DEM topography for the west side. A second phase to identify topographic model(s) appropriate for similar mapping on the eastside is on hold while the recently approved Landslide Hazard Zonation (LHZ) Project is being conducted. Should the LHZ project not complete the Eastside, the Eastside screen could be used to complete coverage. The Westside screen becomes one component of the LHZ project in areas where the landslide hazard zonation will be completed.

Technical Guidelines for Geotechnical Reports (Table 25, line 116)

This project develops technical guidelines for geotechnical reports used in the SEPA review process. The guidelines will include identification of appropriate analytical tools and techniques appropriate for different projects and at different scales.

Regional Unstable Landforms Identification (Map/Deep-Seated Landslide Screen) (Table 25, line 117)

This active project provides a coordinator to work with TFW cooperators within each DNR region in order to identify unstable landforms that do not meet the present statewide landform descriptions. The project also serves as an interim screen for deep-seated landslides by identifying lithologies that promote deep-seated landslides; however, it is not intended to map them. The results of this program are being incorporated into the LHZ project.

Landslide Hazard Zonation (Table 25, line 119 and 120)

This is a multi-phase project. A completed phase has collected and collated Watershed Analyses including information on unstable landforms and placed this information in a GIS database. A currently active phase Landform Hazard Classification System & Mapping Protocols Project is developing a statewide standard for assigning hazard to unstable slopes and completing unfinished mass wasting assessments in partially completed Watershed Analyses. The proposed last phase will provide consistent identification and evaluation of unstable landforms in high priority areas that are not covered by Watershed Analyses and are within FFR jurisdiction.

3.4.9 Glacial Deep-seated Landslide Program

The Glacial Deep-seated Landside Program addresses the need for a tool to assess the failure potential of deep-seated landslides in glacial sediments resulting from changes in groundwater hydrology due to timber harvest in recharge areas. This program consists of two projects and is administered by UPSAG.

Project Descriptions

Model Evapo-Transpiration in Deep-Seated Landslide Recharge Areas (Table 25, line 122)

This completed project developed an analytical model for assessing the evapo-transpiration changes resulting from timber harvest. The model is intended to be applied to timber harvest within the recharge area of deep-seated landslide in glacial sediments. The model has been developed but was not directly validated and refined because of insufficient field data. We anticipate reopening the project and implementing a validation/refinement study as a second phase when the appropriate data field data become available.

Method to Assess Vulnerability of Deep-Seated Landslides to Timber Harvest (Table 25, line 123)

This multiphase project will integrate the existing analytical model with site-specific slope stability analysis to develop a site-specific assessment methodology that determines the potential for failure of deep-seated landslides subject to harvest in the recharge area. We anticipate two phases: Phase 1 will integrate the evapo-transpiration model with a soil moisture/recharge/slope stability model and Phase 2 will field test the model.

3.4.10 Wetland Tool Program

This program consists of two projects and is administered by WETSAG.

Project Descriptions

Hydrogeomorphic Wetland Classification System (Table 25, line 125)

This project will be designed to identify hydrologic and geomorphic criteria to aid in the classification of wetlands.

DNR GIS Wetlands Data Layer (Table 25, line 126)

This project will be designed to develop a GIS data-layer based on physical properties utilizing the hydro-geomorphic classification system.

4.0 CMER ACTION PLAN

4.1 INTRODUCTION

This chapter describes the action plan to implement CMER research and monitoring agenda. It begins with a section describing how CMER established priorities among programs based on an assessment of risk and scientific uncertainty. This is followed by a section describing how individual projects were prioritized based factors such as extent to which projects are essential in accomplishing FFR adaptive management objectives, the status of some projects relative to policy decisions on adaptive management, input from DNR relative importance of rule tool projects, and need to complete work that is already underway. The chapter concludes with a section on the proposed budget and schedule action plan, which integrates CMER program and project priorities, describes how funds will be allocated to move priority project forward, and provides a schedule and timeline for work on priority projects.

4.2 PROGRAM PRIORITIES

The first step in the prioritization process was to rank the relative importance of proposed programs in meeting FFR goals and objectives in order to focus CMER resources and effort on critical areas. This is an important step because over the near-term the proposed research and monitoring projects exceed the availability of funding and the capabilities of human resources. Establishing priorities will allow CMER to pursue research and monitoring objectives in an

orderly manner over time. The CMER strategy for program ranking and prioritizing its work is based on discussions with the FFR policy committee, the group with oversight responsibility for reviewing CMER priorities and budget. The program prioritization strategy is to:

1. Rank effectiveness/validation monitoring and extensive monitoring programs on the basis of scientific uncertainty and risk to aquatic resources;
2. Rule tool programs will be evaluated in consultation with DNR on their importance for rule implementation and prioritized on a project basis
3. The intensive monitoring program needs further scoping and coordination with other efforts before it can be prioritized and integrated into the CMER action plan.

4.2.1 Effectiveness/Validation and Extensive Monitoring Program Rankings

Effectiveness/validation and extensive trend monitoring programs were ranked by CMER members in attendance at the December 19, 2002 CMER meeting who assessed the merit of each program by asking two questions:

1. How certain are we of the science and/or assumptions underlying the rule?
2. How much risk is there to the protected resource if the science and/or assumptions underlying the rule are incorrect?

These questions were chosen to rank programs because uncertainties and gaps exist in the scientific foundation for the FFR and the underlying assumptions about risks to aquatic resources. CMER was charged with reducing these uncertainties through effectiveness and validation monitoring and research and then recommending modifications to the rules as necessary through the adaptive management process. Uncertainty is a measure of confidence in the science underlying a rule, including the scientific relationships providing the conceptual foundation for the rule, the assumptions incorporated into the prescription, or the response to the prescription when it is applied on the ground. High uncertainty (low certainty) indicates that little is known about the underlying science and the rule is likely based on speculation and poorly informed assumptions. It may also indicate that the prescription treatment is untested, and the performance under field conditions is unknown. Low uncertainty (high certainty) indicates that the science underlying the rule is well known and accepted, or that the prescription (or similar treatments) has already been evaluated under similar conditions. Risk is a measure of the potential for detrimentally impacting aquatic resources and thus undermining the intent of the FFR goals, e.g. harvestable fish populations, stream associated amphibians, and water quality. A high-risk assignment indicates the rule component under study has a greater potential to alter the resource because of its high magnitude, frequency, and/or direct linkage to the resource. A low risk assignment indicates that the rule component has a lesser potential to alter the resource because of its low magnitude, frequency, and/or indirect linkage to the resource.

The individual scores were averaged to obtain mean risk and mean uncertainty scores for each program. These were multiplied to get a combined score that was used to rank effectiveness/ validation and extensive trend monitoring programs. The results are presented in Table 24. The FFR Policy Group accepted the rankings and instructed CMER to use them as the basis for prioritizing effectiveness/validation and extensive trend monitoring projects.

Table 24. CMER rankings for effectiveness/validation programs.

Program Title	Overall Ranking	Uncertainty		Risk	
		Mean	Rank	Mean	Rank
Effectiveness/Validation Programs					
Type N Buffer Characteristics, Integrity Function	1	4.4	1	3.9	1
Eastside Type F Desired Future Range and Target	2	4.2	2	3.8	2
Type N Amphibian Response	3	4.2	2	3.7	3
Road Basin-scale Effectiveness Monitoring	4	3.4	5	3.4	4
Type F Statewide Prescription Monitoring	5	3.2	7	3.1	6
Mass Wasting Effectiveness Monitoring	6	3.2	6	2.9	8
Eastside (BTO) Temperature	7	3.0	9	3.2	5
Wetlands Revegetation Effectiveness	8	3.5	4	2.7	11
Road Site-scale Effectiveness Monitoring	9	2.6	14	3.1	6
Hardwood Conversion	10	3.0	8	2.6	12
Wetland Mitigation	11	2.8	11	2.7	10
Fish Passage Effectiveness Monitoring	12	2.6	14	2.9	9
Wildlife Program	13	2.9	10	2.4	14
Wetland Management Zone Effectiveness Mon.	14	2.8	12	2.5	13
CMZ Effectiveness Monitoring	15	2.7	13	2.1	15
Forest Chemicals	16	2.0	16	2.1	16
Extensive Trend Monitoring Programs					
Extensive Riparian Monitoring	1	3.5	2	3.5	1
Extensive Mass Wasting Monitoring	2	3.7	1	2.9	3
Extensive Fish Passage Monitoring	3	3.1	3	3.1	2

4.3 PROJECT PRIORITIES

The next step in developing the action plan was to make decisions about budget and scheduling for individual projects proposed by various SAGs. To do this, individual projects were assigned to categories based on their importance to the adaptive management program and their current status. The system for categorizing projects is as follows:

- (P) Policy. Projects being implemented at policy request or projects which require policy action before they can proceed.
- (E) Essential. Projects that are critical components of high priority effectiveness/validation or extensive monitoring programs based on risk and uncertainty (see section 4.2 above) or important rule tool programs. Essential projects were also screened for consistency with the intent of FFR.
- (F) Finish. Projects that are currently underway and should be completed.
- (blank) Unrated. Projects that do not fit into one of the previous three categories.

The projects were initially sorted into these categories by the CMER co-chairs. This work was presented to CMER and discussed at the December 2003 meeting. After making some revisions,

CMER approved the list of projects and the categorizations which form the basis of the 2004 CMER Action Plan.

4.4 CMER ACTION PLAN

The CMER action plan is shown in Table 25. In addition to listing the projects and the categories they are assigned to, the action plan also provides budget information (including the currently approved budget for FY 2004 as well as projected budgets for future years). Projects with approved budgets for FY 2004 are either underway, or are expected to be initiated in FY 2004. Projects without approved budgets for FY 2004 but with proposed budgets for future years are in the planning stage. Implementation of these projects will depend upon obtaining approval for the requested funds from the Forest Practices Board.